This Issue

DESIGN AND PRODUCTION

New type of structure increases range 2½ times, page 23.

Airplane and engine design twenty years ago, page 15.

Production spot welding of aluminum alloy, page 29.

More power and lower fuel consumption in G Cyclone Engine, Flying Equipment.

A control system designed for simplicity and low maintenance cost, Flying Equipment.

TRANSPORT

Air Commerce Bureau to regulate traffic, News Section.

Economics of "all express" planes. News Section.

Air line practice applied to commuting service, page 32.

P.A.A. and P.A.A.-Grace speed up service, News Section.

New Electras for Hanford, News Section.

ARMY AND NAVY

Army sets up board to select base in Alaska, News Section.

Navy orders 50 patrol bombers from Consolidated, News Section.

Army buys attacks from Curtiss, trainers from Stearman, and three Electras, News Section.

PILOTS AND FLYING SERVICES

The medical examination problem again, page 51.

Records are broken at Elmira soaring meet, page 26.

A model commuters' service, page 32.

New airplane in the low-price class, Flying Equipment.

Published monthly, price 25c a copy. Subscription rates—United States, Canada, Mexico and Central and South American Countries, $3.00 a year. All other countries, $6.00 a year or 24 shillings. Application for entry as second-class matter at Albany, N. Y., pending. Printed in U. S. A. Cable address "McGrawhill, New York." Member of A.B.C. Copyright 1936, by McGraw-Hill Publishing Company, Inc., 330 West 42d Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL, and THE AVIATION NEWS. All rights to above names are reserved by the McGraw-Hill Publishing Company.

AVIATION

Established 1916 . . . McGraw-Hill Publishing Company, Inc.

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

Louis F. Stoll, Vice-President

S. Paul Johnston, Editor

Leslie E. Neville, *Managing Editor* — Charles G. Cleveland, *News Editor* — Paul Wooton, *Washington*

★

Contents for August, 1936

Volume 35, Number 8

Twenty Years Ago 15
AVIATION celebrates its twentieth anniversary

Egg Shell Airplanes *By Major Oliver Stewart* 23
First exposition of geodetic construction

353 Hours of Soaring 26
Impressions of the Elmira Meet

Spot Welds Save Spot Cash *By C. Weston Steward* 29
In aluminum alloy production

One-Man Airline *By Rodney Jackson* 32
A commuter service that runs like an airline

Editorials 34
Without Armor; Men Wanted; A Tip from the Railroads

Flying Equipment 35
Flying the Ryan ST; G Cyclones; Eclipse Booster; Direction Finder; Fairchild Ranger 24; Three Radios; Two Seaplanes; Porterfield Zephyr; with Foreign Builders

Buyers Log Book 51
A review of new equipment for the industry

Operators' Corner 52
Medical examinations; Charter Rates

News of the Month 55
Bureau to regulate traffic; Express planes; Industry notes

Schools, Services and Airports 65
A state-by-state tour of the flying fields

Aviation People 73
Who is who and what they are doing

Side Slips *By Robert R. Osborn* 75

★

McGRAW-HILL PUBLISHING COMPANY, INC.

Publication Office: 99-129 N. Broadway, Albany, N. Y.

Editorial and Executive Offices: 330 W. 42d St., New York City

JAMES H. McGRAW, JR., Chairman — MALCOLM MUIR, President — JAMES H. McGRAW, Honorary Chairman

LOUIS F. STOLL, Vice-President — B. R. PUTNAM, Treasurer — D. C. McGRAW, Secretary

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

The Birdmen's Perch

After flying through this page "on the instruments," fellows—how about sharpening an old valve stem, and sending us a bit of news about yourself or your friends? We thrive on red-hot exhaust stack gossip. Direct your correspondence to

"Tattered Wing Tips," alias AL WILLIAMS
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

SOMETHING TO CHEW OVER

"Several weeks ago, a tourist arriving in Miami discovered he had left one of life's little necessities in a Nassau hotel. He wired the hotel, and a few hours later a small package was delivered to him by air. The tiny parcel contained a false tooth. The tooth, and nothing but the tooth, so help me."

—W. N.

HOT AIR MAN

"At Oakland airport, several years back, there was a lad who figured he was God's gift to aviation. His cocky attitude used to burn one of the inspectors up.

"When the lad came up for his pilot's license, he drew the grouchy inspector. After going through the necessary paces (and a few unnecessary ones) the tyro taxied in.

"As the ground hogs drew around, the youngster bounced out and yelled, 'How'd I do, old timer?'

" 'Great, boy, just great,' the inspector snapped. 'Outside of a rotten take-off, too fast a climb, drifting on the turns, skidding on the spirals, landing with one wing low and undershooting the mark, you just bowled me over with the way you handled that ship.'

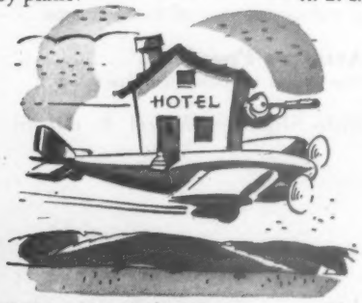
"But the boy wasn't bothered. He immediately piped back, 'Well, old knobs, did I climb out of the plane okay?' Doubt me if you will, but he got his license!"

—B. N.

DID YOU KNOW?

"That a pilot in Wyoming makes a mighty good living hunting coyotes by plane."

—H. B. L.



"That a wooden hotel was carried fifty miles by plane in New Guinea . . . from a mountain lumber camp to a town on the coast."

—W. K.

That Gulfpride Oil is made from selected 100% Pennsylvania crudes. Then carried a long step further by Gulf's exclusive Alchlor-process. Result—a super oil that forms only 1/5 to 1/3 as much carbon as other Pennsylvanias.

James McCrackle Montgomery Swogg
Had the world's most famous Jumping Frog.

While Hector Hannibal Henry McGeek
Had a frog that was pale and puny and weak.

The husky frog was "Danville Dread"
And the puny frog was just called Fred.

'Twas the day of the Annual Frog Jump Meet
And the Danville Dread cleared thirty feet!

The crowd went wild and yelled "By, Gee!
That's the greatest jump in history!"

And they all just booed when McGeek came up
With his hopeless frog and an old tin cup.

Alas! Poor Fred seemed quite done in
Till he took a drink from the cup of tin.

Then he cocked his eyes and raised his head
And he gave a croak that woke the dead.

He licked his lips and thumped his chest
And flexed his legs for the mighty test.

With a giant jump, he *soared* away
And didn't land till a year from May.

They brought him back in a private train
And drank his health with French champagne.

But Fred just croaked for his old tin cup
With the good old drink that pepped him up.

You know the 'drink', it heads the class.
It's good Gulf Aviation Gas.

—F. Z.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF
GULF AVIATION PRODUCTS

AVIATION *for August, 1936* ★ ★ ★ ★ ★ ★

TWENTY YEARS AGO—

AVIATION was born. Among our most valued possessions is a yellowing scrap of paper on which Lester Gardner wrote for the first time the name of the new publication. Among our records there is none more inspiring than that part of his lead editorial in the first issue in which he stated the aims of the magazine, a program from which his successors have never departed, and which stands today as a basic policy of the paper.

> "AVIATION . . . intends to assemble this vast amount of (aeronautical information) and make it useful to the constructor, the engine maker, the aviator and the sportsman. It will follow construction both abroad and in the United States, and present the latest developments in accurate, scientific and unbiased form. . . . By recording the work of American aeronautical engineering, the world will soon be made aware that the birthplace of the aeroplane is still maintaining its leadership in aeronautics . . ."

Historically speaking, twenty years is a short time. But in aviation, the last two decades span almost the whole lifetime of practical aircraft. Prior to the outbreak of the European War of 1914 design and construction were weird and wonderful things. Nowadays it is difficult to realize how little was then known of the fundamentals of aerodynamics. The astounding variety of forms that appeared on pre-War airdromes gives grounds for suspicion that an ouija board might have been the most useful tool of the designer's kit. By 1916, however, the airplane was beginning to emerge from the fiery furnace of war in a tempered and refined form. The ideas of crackpots and visionaries simply would not stand up under the hot blast of military necessity. Scientific research displaced the heritage of Jules Verne, and the ouija yielded to the slide rule. It was at this stage that AVIATION began its first twenty years of service to the new-born industry.

It is an interesting experience to leaf through Volume One, not only to survey the array of L.W.F.s, Curtiss JN-4s, L.V.G.s, and Albatrosses, then the last word in flying equipment,—but also to note the number of men then appearing as young authors who are now among the top-flighters in this aviation business. Among them: Grover Loening, "Ginnie" Clark, "Captain Dick" Richardson, Jerry Hunsaker, Ed Warner, Tom Huff, Alex Klemin and Ralph Upson. Striking also, considering the economic ups and downs of twenty years, the list of advertisers of 1916 whose names are still included on the roster of American business. Noted were: Glenn L. Martin, Curtis Aeroplane & Motor Company, the Sperry Gyroscope Company, Goodyear, U.S. Rubber Company, Foxboro Company, Inc., Taylor Instrument Company, Moto-Meter Company, DuPont Chemical and Park Drop Forge Company. These certainly are to be numbered among the pioneers of commercial aviation, whose efforts have contributed in no small measure to the building of the industry as we know it today.

But it would be decidedly misleading to limit our search for pioneers to the pages of the original issues of AVIATION. Even one of Lester Gardner's outstanding ability as a publisher could scarcely have hoped to attract to his young and struggling sheet *all* the available talent of the period as contributors, or *all* the firms then in business as advertisers. From other publications — directories, old books and magazines—from old files and by solicitation of information from survivors, we have assembled a kaleidoscopic picture of the period. It is presented only as a series of snap shots, and is not in any sense a historical record of the twenty years since. Others have done that far better than we could hope to do in the space at our command. Admittedly, too, our picture is probably far from complete. Records have been lost and old pictures have faded. To those who have been inadvertently omitted, our apologies. After all, they have already written their own records in more enduring stuff than printer's ink.

In the beginning were the Wrights (left) and Glenn Curtiss (below).

The late Lawrence Sperry, twenty years ago.

The late Chance Vought flying a Wright plane.

Reginald E. Gillmor when he was vice-president of Sperry.

Thomas Morgan shortly after he left the Navy to go to Sperry.

Although we are confining our attention chiefly to the period 1916-17, it is only fitting that tribute be paid in passing to those earlier pioneers of American aviation from whose efforts all subsequent activities have stemmed. Ladies and Gentlemen: We give you the Brothers Wright, first conquerors of the air in powered machines; and Glenn Curtiss, whose mechanical genius is responsible for many of the essential features of our present aircraft!

By 1916 the name Sperry was already well established in the aeronautical world. It was only natural that the genius Elmer Sperry and his sons had applied to marine navigation should be turned toward problems of aerial navigation. The Sperry Gyroscope Company of that period had not only developed and marketed magnetic compasses for aircraft, but had extended their field to cover other

An early "Tommy-Morse" single seat fighter rolls off the production line.

Although Charles Lindbergh had little direct interest in the aviation industry in 1916, he will always rank among the pioneers.

"Apparatus that aids Aviators" (Sperry Folder No. 36), including drift sights and bank, inclination and incidence indicators. By that time work had been far advanced on automatic flight control for airplanes. Of immediate interest then was its application to the aerial torpedo, but from that research sprang the modern Gyropilot, now to be found as standard equipment on most airliners.

Associated with the Sperry interests today are a number of men whose aviation activities date back twenty years or more. In 1916, Thomas A. Morgan, now chairman of the board, was in charge of the aeronautical instrument department; Reginald E. Gillmor, president, was managing director in London; Elmer A. Sperry, Jr., now consulting engineer, was working on aviation development with his distinguished father.

The name Curtiss is stamped indelibly on the minds of all who participated in military aeronautics during the War and in the pre-War period. The "Jenny" and the OX-5 were integral with the times. Their ancestors were the earliest Curtiss plane and engine produced at Hammondsport in 1907. Their descendants are legion. In 1915 a commission of British officers in America had declared that the JN was the most perfect airplane so far developed and within a year hundreds of them were in active service in British and American training centers. By 1916 Curtiss flying boats were well developed following Glenn Curtiss' successful experiments of 1911. Multi-engined types were in existence at that time. Rodman Wanamaker's Transatlantic hope, the "America" was completed and the groundwork had been laid for the "F" boats (long remembered by naval cadets of the period) and for the famous NC boats destined to achieve fame as conquerors of the Atlantic.

Parallel to Curtiss developments of twenty years ago, another company was forging ahead, later (1929) to join interests with it. Six years after Kitty Hawk, the Wright Company had been organized by Orville and Wilbur. It existed as a separate unit, supplying planes to the services and to private owners until 1916 when it was merged

Charlie Kirkham in one of his early airplanes.

Major Bayeroft Walsh when he was in command of France Field.

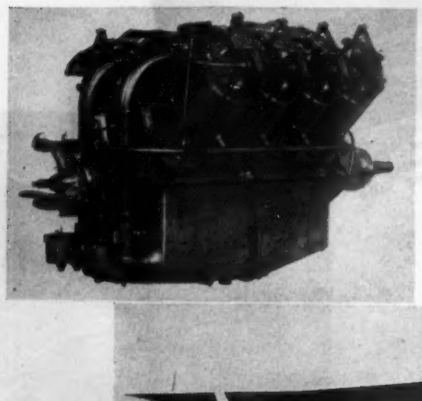
First Pratt & Whitney Wasp engine.

The Sikorsky attack plane of 1916.

Igor Sikorsky (left) at the Russian front in 1915.

Matty Laird in the days of the "Swallow."

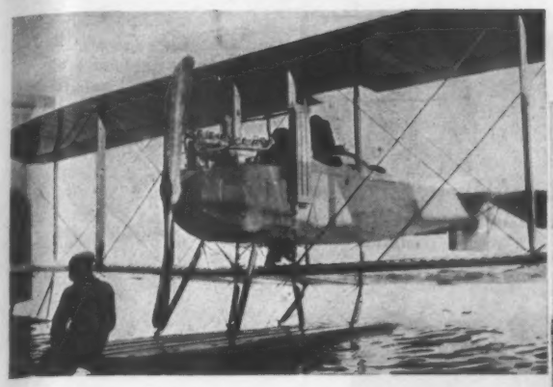
Top—Old reliable,—the Curtiss OX-5. Below—Wingskids and wires as used on a Jenny.



with the Martin interests of Los Angeles to form the Wright-Martin Company. In 1916 the new company selected the Hispano-Suiza engine design as the most adaptable for War-time purposes and embarked on a production program. Work first concentrated on the 150 hp. model, but by 1918 manufacture was in full swing on the 300 hp. series. A program for 100 such units a month was set for early 1919 had the War continued. Interesting to note that Guy Vaughn, present president, joined the company as quality manager in 1916.

Following the War the Wright-Martin Company was dissolved, with the Wright Aeronautical Corporation taking over all work on engines. Later (1922), by purchase, the company acquired the services and experience of Charles L. Lawrance, who had been engaged in the manufacture of air-cooled engines since 1914. Two and three-cylinder models had appeared and had been tested during the War, but it was not until several years afterward that both Army and Navy became sufficiently interested in radial types to encourage development. The results of the Lawrence-Wright combination are well known. Whirlwinds and Cyclones power many modern aircraft. It was a Whirlwind which carried Charles Lindbergh to Paris and to fame in 1927.

Although the present Consolidated Aircraft Corporation (San Diego, Calif.) dates only from 1923, when it was founded in Buffalo by Maj. Reuben Fleet, one of its component parts—the Thomas Morse Aircraft Corporation, was an important production unit in 1916. "Tommy Morse" trainers and fighters were familiar sights on military flying fields in the War and post-War period. Among those now connected with Consolidated, however, are many whose aviation activities cover the twenty-year period. Major Fleet, then a member of the Washington State Legislature, was taking flight training which lead to his pilot's license early in



A Martin boat with a Hall Scott engine.

The Glenn L. Martin Model R biplane.

Orville Wright and Glenn L. Martin.

1917. C. A. Van Dusen, now vice-president and sales manager was working in Glenn Martin's Los Angeles factory in 1916. "Mac" Laddon, vice-president and chief engineer, was just on the point of leaving a long-standing connection with the Cadillac Motor Car Company at Detroit to enter aviation. J. L. Kelly, factory superintendent, was then engaged in the selection and shipment of propeller lumber in Canada for the French Government, while Edgar N. Gott, assistant to the president, was, in 1916, one of the members of the corporation of Pacific Air Products Corporation, later the Boeing Airplane Company.

Among the pioneers of 1916 who are still active in the business is C. B. Kirkham. An engine designer for many years (he turned out his first design—for a motorcycle—in 1900), he was responsible for the famous OX-5 in 1915 and the V-2 in 1916 in his capacity as engineer for Curtiss Aeroplane & Motor Corporation. In 1917 he is credited with building the first supercharger for aircraft engines in America. He is also an airplane designer of note, his work including his own ship in 1910, the Curtiss 18-T triplane of 1918 and a seaplane racer for Lt. Al. Williams in 1928. He is now engaged in the manufacture of engines and special aeronautical parts at his Farmingdale (L. I.) plant.

The present United Aircraft group, although its own corporate history does not date back to the early days, includes in its present interests several units that were in business twenty years ago, and many "early-birds" are also found among its officials.

Earliest organized was the old Hamilton Propeller Company started in Seattle in 1909 by Thomas F. Hamilton, himself a pilot in those days. In 1916 he moved the plant to Milwaukee, later to be consolidated with the Standard Steel Propeller Company of Pittsburgh to form Hamilton-Standard, largest manufacturers of propellers in the world. Mr. Hamilton is now a vice-president and director of United Aircraft Corporation.

Raycroft Walsh, president of Hamilton-Standard, ended the War a Major in the Air Corps. At one time he was in command of France Field in the Canal Zone.

Chance M. Vought (who died in 1930) organized the original Vought Company early in 1917. He specialized in ships for the U.S. Navy, and today the products of the present Chance Vought Division are found on board most of our naval units.

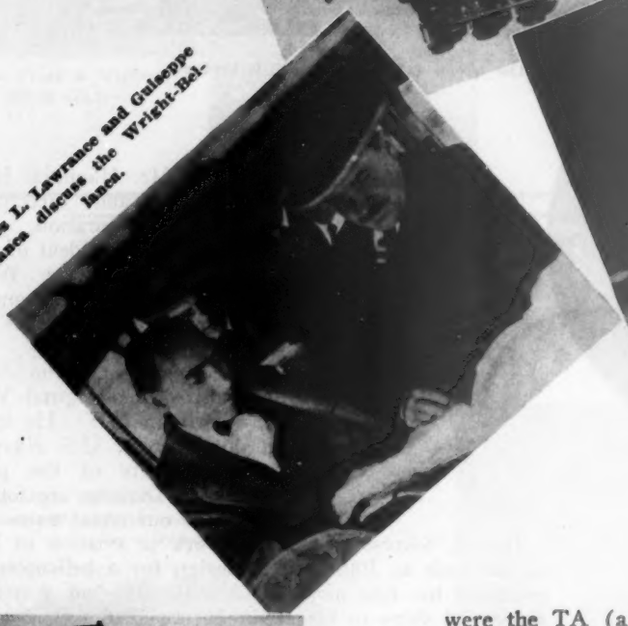
Igor I. Sikorsky began his work in aviation in Russia as far back as 1908 with a design for a helicopter. He produced his first airplane in 1910, and had a string of successful ships to his credit before 1916. By that date he had established himself as an outstanding contractor to the Russian Government, producing several multi-engined airplanes of remarkable size and performance. Forced out of Russia by the revolution of 1917, Mr. Sikorsky went to France where he turned out several designs for the French Government. In 1919 he transferred his activities to the United States where he has established himself a world-wide reputation as a producer of large and efficient aircraft.

Among the oldtimers now in United Aircraft . . . Frederick B. Rentschler, chairman of the board, was Captain in the Army, and an inspector at the old Wright-Martin plant in 1917-18. . . . Donald L. Brown, president, was with Wright-Martin during the War. . . . George J. Meade, vice-president and chief engineer of Pratt & Whitney was an engine designer at McCook Field twenty years ago. . . . Eugene E. Wilson, head of Chance Vought Division, also senior vice-president and director of United Aircraft, supervised the manufacturing and overhaul section of the Great Lakes Training Station in the early days and served with the Battle Fleet, during the later part of the War. . . . Bernard L. Whelan, general manager of United Airports first soloed in 1913 an old Wright pusher, and he has flown practically everything with wings since.

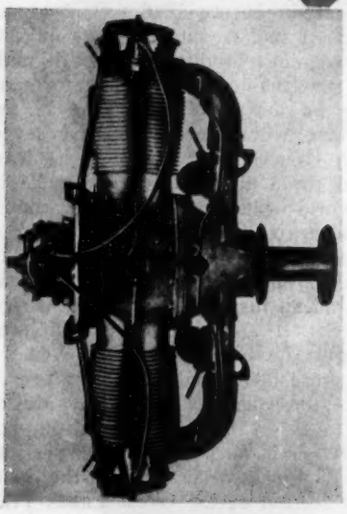
Glenn L. Martin built his first airplane in 1909 and he has been at it ever since. His first factory was established that year at Santa Ana, Cal., and in 1913 he delivered his first plane to the U.S. Army. In the period 1915-16 the company produced airplanes for the United States as well as for the government of Holland and the Netherland East Indies. Models then in production

Cyclone's ancestor, the Wright P engine.

From marine engine manufacturing Guy Vaughn came to Wright Aeronautical.



Charles L. Lawrance and Guiseppe Bellanca discuss the Wright-Bellanca.



Forerunner of radials,—the two-cylinder Lawrance engine.

were the TA (a 100 hp. hydro), the S (a 125 hp. hydro) and the R (a 125 hp. land reconnaissance plane). In September, 1916, Mr. Martin assisted in the formation of the Wright-Martin Aircraft Corporation, but withdrew shortly to form his own company in 1917. His original plant was in Cleveland, Ohio, later moved to the present magnificent layout near Baltimore. Long time a contractor to the Army and Navy, Martin entered the commercial field in 1935 with delivery to Pan American of three large flying boats (Model 130) now in Transpacific service.

Guiseppe M. Bellanca is another oldtimer who was very active by 1916. He began his flying in 1906 in Italy, and by 1911 had completed his first airplane and had taught himself to fly in it at Mineola, L. I., U.S.A. Late in 1916 this airplane was still being used by students at Mineola. Mayor LaGuardia of New York learned to fly in it. In 1916 Mr. Bellanca joined the Maryland Pressed Steel Company in developing two military types for the Army Air Corps, but the War was over before these airplanes were placed in service. A list of Bellanca records during the last twenty years is impressive and much too long to reproduce here. Suffice it to say that Bellanca-built machines have been outstanding performers where long-range and ability to carry load was a primary requirement.

Twentieth anniversary of the Boeing Aircraft Company coincides with that of AVIATION. In those twenty years the company has produced 2,000 airplanes of 62 different types. In 1916 the first unit of Boeing's factory was built on Lake Union in Seattle (in 1917 operations were moved to the buildings shown in one of the accompanying photographs). The first production airplane turned out was the Model B & W, shortly followed by the C-4, a seaplane built to interest the Navy. Early in 1917 50 machines of this type were ordered. Early in '17 the organization began to grow. Among those who signed on at that time and are still with the company

A Boeing seaplane of 1918 vintage with J. T. Hartson in the front cockpit.

Boeing beginning. First factory on the site of the present Seattle plant.

Bill Boeing flying with the first Canadian air mail in 1919.

were C. L. Egtvedt, now president, who came in as a stress analyst; Philip G. Johnson, one-time president of the Boeing Company and subsequently president of United Aircraft & Transport; Lewis Marsh, analyst and engineer, who entered as a draftsman; and John Wilson, now chief inspector, hired as test pilot.

Largest part of Boeing's output has gone to the Army and the Navy, but in 1929 Boeing pioneered in the production of large transport airplanes, the 80 As, and in 1933 delivered to United Air Lines the prototype of all modern transports, the Boeing 247.

No list of pioneer companies would be complete without mention of the Aeromarine Plane & Motor Company, now of Keyport, N. J. Its activities date back far beyond the War period. By 1916 I. M. Uppercu was its president, and Charles Day, later to achieve fame with the Standard and New Standard Companies, was his chief engineer. In 1916 it was producing an engine of the water-cooled inline type as well as several varieties of land and water aircraft. Shortly after the War several large flying boats were built which were used on our first commercial air line. In later years Vincent Burnelli became associated with Mr. Uppercu to develop a series of large airplanes characterized by airfoil shaped fuselages.

Several years before Wichita's "black gold" began to gush into aviation via the pockets of "Jake" Moellendeck

AVIATION

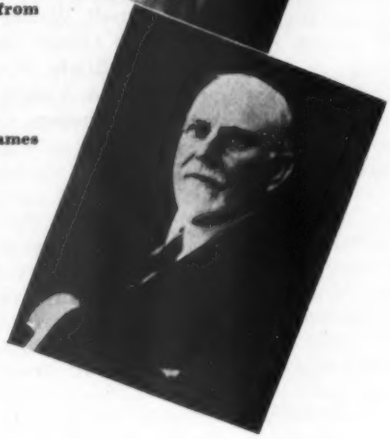
BACK in the days of wing skids, wires, and "inherently" stable airplanes, a group of scholars at M.I.T. listened to the enthusiastic exposition of a plan to accelerate the arrival of aviation's future. The name of the man with the idea was Lester Gardner. The idea was AVIATION. Thus this publication was founded in 1916, as *Aviation and Aeronautical Engineering*. In 1920 the *Aircraft Journal* was absorbed and the title became *Aviation and Aircraft Journal*. This was simplified to AVIATION in 1922.

In 1927 came the first change in ownership. The new publisher was Earl D. Osborn, founder and president of Edo Aircraft Corporation. In 1929 the publication was again sold, this time to the McGraw-Hill Publishing Company.

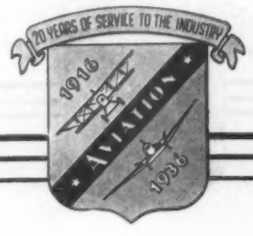
Past chief editors of AVIATION have been Ladislas d'Orcy, W. Laurence LePage, Earl D. Osborn, R. Sidney Bowen, Jr., and Edward P. Warner.

The founder, Maj. Lester D. Gardner.

Earl D. Osborn, who published AVIATION from 1927-1929.



Present publisher, James H. McGraw, Sr.



(Father of Aviation in Wichita) in 1919, two pioneers were in the hospital—not an infrequent occurrence in those days. They were Clyde Cessna and Matty Laird. To Clyde goes the distinction of having built the first airplane manufactured in Wichita at the old Jones Motor Car plant (later the Stearman plant) in 1917. This ship, his fourth venture, was a small monoplane which presaged its descendants in many ways.

In 1916 Matty designed, built and looped his original two cockpit, Anzani powered "Boneshaker," third product of the Laird line. The famous loop, which was then the sixth performed by American pilots (including Lincoln Beachey, Art Smith, and Katherine Stinson) marked the beginning of the Laird career as an exhibition flyer. By 1919 the E. M. Laird Company of Chicago was building the Model S which preceded the famous "Swallow" and possessed cleanness and efficiency far ahead of its time. But the "black gold" lured Matty back to Wichita where he took an important part in the boom of the early twenties.

About this same time, Laird's erstwhile partner "Buck" Weaver, was turning from barnstorming to manufacturing and, with Clayton J. Bruckner (now president of Waco) and E. J. Judkin, formed the Weaver Aircraft Company at Lorain, Ohio. Purpose of the company was to build a light airplane to be the "Ford of the air." One division of a subsequent split in the Weaver company was the Advance Aircraft Co., predecessor of Waco.

When the War broke out, Eddie Stinson, test pilot of Kinlock Field, St. Louis, enlisted in the Army and instructed hundreds of students at Kelly Field. After the War he founded the Detroit Stinson Company which later became a unit of the Cord Corporation.

Beyond the producers of complete airplanes and engines a number of accessories and parts manufacturers date their participation in aeronautics back over the last twenty years. Exide storage batteries (Electric Storage Battery Company, Philadelphia) were in use on military airplanes during the latter stages of the War. . . . Hartzell propellers (Hartzell Propeller Company, Piqua, Ohio) were in wide use by 1916. . . . Titanine finishes (Titanine, Inc., Union, N. J.) were introduced in this country from England by E. G. Davis, present manager of the company early in 1917. . . . B. G. spark plugs (The B. G. Corporation, Richard Goldsmith, president) came into the picture nineteen years ago. . . . Although instrument boards were still quite bare, comparatively speaking, in 1916, Weston (Weston Electrical Instrument Corporation, Newark, N. J.) ammeters and volt meters were seen, particularly with Liberty engine installations. . . . Fafnir bearings (Fafnir Bearing Company, New Britain, Conn.) were installed in Liberty motors in large quantities, were also used on Hispano-Suiza and Le Rohne engines. Over 5,000 Fafnir ball bearings were used on control pulley applications on flying boats turned out by the Naval Aircraft Factory in early '17. . . . companies now associated with the Standard Oil interests were supplying fuels to the services twenty years ago.

OLD TIMERS

American Manufacturers listed in "The Flying Book," (the Aviation World's Who's Who and Industrial Directory, published in England, 1918) who are still active in Aviation.

Aeromarine Plane & Motor Company
Airplane & Marine Direction Finder Corporation
Aluminum Company of America
American Bronze Company
The B. G. Corporation
Bound Brook Oil-less Bearing Company
Champion Ignition Company
Chelsea Clock Company
Curtiss Aeroplane & Motor Corporation
Doehler Die Casting Company
E. I. duPont de Nemours & Company
Electric Storage Battery Company
Fafnir Bearing Company
Foxboro Company, Inc.
Goodyear Tire & Rubber Company
Hartzell Walnut Propeller Company
F. B. Heath Aerial Vehicle Company
Hess-Bright Manufacturing Company
Lewis & Vought Corporation
Lunkenheimer Company
Glenn L. Martin Company
Moto-Meter Company, Inc.
Meizel Press Mfg. Company
Norma Company of America
Pacific Aero Products Company
Park Drop Forge Company
Pruden & Company
John A. Roebling & Sons Company
S.K.F. Ball Bearing Company
Sperry Gyroscope Company
Strauss & Buegeleisen
Taylor Instrument Companies
Titanine, Inc.
United States Rubber Company
Vacuum Oil Company
Waltham Watch Company
Whitman & Barnes Mfg. Company
Weston Instrument Corporation
Wright-Martin Aircraft Corporation
Wyman-Gordon Company
Zenith Carburetor Company

Two geodetic planes. The Vickers long range bomber (above) and the Wellesley (below).

Egg Shell Airplanes

Geodetic construction increases bomber range 2½ times

By Oliver Stewart

AVIATION'S *British Correspondent*

So far, little has been published in this country of the details of a new type of airplane construction that has recently appeared in England. We are fortunate, therefore, in being able to present to the readers of AVIATION Major Stewart's first-hand account of what it is all about.

BARNES NEVILLE WALLIS, tall, grey-eyed, severely academic, when asked at a scientific meeting to describe his new geodetic system of aircraft construction,—a system which has set every airplane designer in England thinking hard—smiled behind his gold rimmed spectacles and jested: *"There's really nothing in it."*

In spite of the complexity of the calculations involved. Mr. Wallis' jest is literally true, and sums up the essential feature of geodetic construction. Inside a geodetic wing there are no struts or spars, no bracing wires, compression struts or formers. Inside a geodetic fuselage there are no tie rods, no frames nor even longerons in the ordinarily accepted sense of the term. In fact when one looks inside a geodetic wing as I did at the Vickers works at Weybridge, where machines are being built on this system, one sees an interior completely free from internal bracing.

Geodetic construction is taking Professor Sutton Pippard, leading English mathematician, and two assistants about two years to analyse mathematically. It has puzzled the most advanced scientists in the country to evolve formulae for strength calculations. If it fulfils its promise (and the two machines already built on this system suggest that it will do so) it will be one of the biggest advances ever made in structural method. It should enable the range of an airplane with a given motor to be more than doubled and, at the same time, a larger load to be carried.

I know that Mr. Wallis would be grieved to see his construction likened to that of an egg shell, but the egg shell in one respect, at least, has some resemblance to geodetic construction. Within its limitations it is extraordinary strong. Moreover forces acting on it are not diverted from the outside surface to struts and spars inside. They are all taken by the outside surface so that the interior is completely free for useful load. In a geodetic wing, the forces are made (in Mr. Wallis's own words) to "crawl round the contours" instead of being short-circuited by a secondary system of inside struts, spars and rods.

Geodetic construction puts the material where it is most wanted, in the contours of the wing or fuselage, and in that respect it may be said to resemble the stressed skin form. But it entirely and radically departs from that form in the way the material is arranged. Strip off the thin metal or fabric covering from a geodetic wing or fuselage and underneath you will see a web formed by numbers of criss-crossing duralumin channelled strips, their width always normal to the contour. In other words, these channelled strips are set on edge, and they meet and cross one another at special fittings which cause their neutral axes to intersect. They do not run fore and aft, or laterally, but *diagonally*, and to get at the purpose behind this arrangement it will be necessary to go back to some of Mr. Wallis' previous work.

As the chief engineer of the Airship Guarantee Company which built the airship R.100, it was he who devised in the first instance the arrangement of the passenger compartments within the hull, an arrangement since used by the German Zeppelin Hindenburg. After Great Britain abandoned the building of airships, Mr. Wallis joined Vickers (Aviation) Ltd. of Weybridge as chief designer (structures). He then turned his attention to the obtaining of improved performance from military airplanes. He reasoned that the speeds needed in modern aircraft can be most easily attained by the use of the monoplane form with low resistance wing and body. At the same time the calculations which led him to this conclusion also

showed him that the most aerodynamically efficient monoplane would differ vastly from the sort in current general use. Here then was the stimulus which brought geodetic construction into existence.

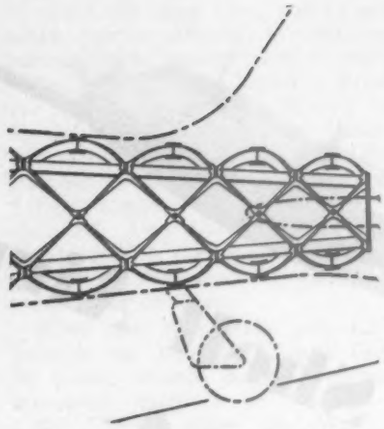
Optimum Monoplane

His investigations showed that the desirable characteristics of a monoplane should be: (1) aspect ratio between 9 and 10; (2) wing root depth-chord ratio not greater than 17 per cent; (3) great torsional rigidity of wing; (4) great stiffness and torsional rigidity of fuselage; and (5) very light structural weight.

Features one and two are noteworthy. The selection of the monoplane form of high aspect ratio is based upon the theory that the lift of a plane may be approximately represented by a cylinder of diameter equalling the wing span. The magnitude of this cylinder is not altered by alterations in the chord.

The high aspect ratio monoplane is, therefore, the form best suited to modern performance requirements. Furthermore, for maximum efficiency, the wing section must be relatively thin. No stressed skin monoplane has been produced which meets both conditions and calculation suggests that no stressed skin monoplane can be so built within an economical weight limit. When the wing root thickness-chord ratio is held constant, it can be shown that with any given form of construction, the weight of a wing of constant area and wing loading and designed for equal speed varies directly faster than the square of the aspect ratio. This is the practical form taken by the well known "cube law" of structures.

According to theory the weight of geometrically similar structures goes up as the cube of the lineal dimensions, but inasmuch as such things as control rods and ailerons increase only slightly in weight, actually the weight goes up somewhere between the square and the cube of the dimensions. Thus, if two wings of constant area, loading, speed and thickness-chord ratio have aspect ratios of 6 and 9 respectively, then, in a given construction, the wing of aspect ratio 9 will weigh $\left(\frac{9}{6}\right)^{2.5} = 1.5^{2.5}$ or 2.75 times the weight of the wing of aspect ratio 6. The result is that if aspect ratios sufficiently great to enable the monoplane form to be used to best advantage are to be employed, a very light construction is essential. But points (3) and (4) above must also be borne in mind, because lack of torsional rigidity in a wing leads to disastrous and generally fatal defects such as reversal of control, divergence and flutter. Lack of stiffness and torsional rigidity in a fuselage leads to vibration at some critical speed and to buffeting.



Tail section of a geodetic fuselage

Mr. Hibbard, of the Lockheed Aircraft Corporation, read a valuable paper before a German Aeronautical Society in which he quoted a typical average value of the aspect ratio of modern monoplanes of the order of 6½. Compare this with the 9 to 10 figure demanded theoretically to meet the conditions laid down by Mr. Wallis. Stressed skin construction has been widely adopted in order to obtain torsional rigidity at high speeds; but aircraft built in this way usually possess only the minimum factor of strength necessary to secure a certificate of airworthiness. Mr. Wallis demonstrates that material used in the form of a skin is in the worst form for resisting load, although its position in the structure is the best. Material used in the concentrated form of rods, bars or tubes is capable of developing far higher strength than when in plate form. Stressed skin constructors must therefore choose between a low factor of safety, with its consequential low loading on the aircraft, or a very heavy structure.

In brief, investigation showed that progress in performance was being blocked by structural limitations. The geodetic construction is the method advanced by Mr. Wallis to clear the way.

Why "Geodetic"?

A geodetic line may be defined as the line that will be taken up by a flexible string when tightly stretched over a curved surface between two points lying in that surface. An alternative definition is: A geodetic line is the shortest distance between any two points in a curved surface, when the path lies wholly in the surface. The word *geodetic* is the adjective; *geodesic* is the noun.

Geodetic construction gives the stiffness obtained by the stressed skin owing to the advantageous position of the material, and at the same time it gives the strength obtained by using material in the form of bars or tubes. Such concentrated members lie wholly on the curved surface of the body and are made to follow geodetic lines traced out on the surface. We now see the reason for the diagonal pattern formed by the web of geodetic members under the coverings of the wing. The neutral axes of the members are arranged as geodesics in the curved surfaces of wings and fuselage. If one looks along inside a geodetic fuselage one sees these curves more plainly than in a wing. The members wind round and round, crossing one another and forming a sort of two-way spiral.

This spiral is a system of balance, each geodesic balancing the other. And it is important to note that the balance is *instantaneous*. There is no lag while loads are being accepted. The structure is stiff in torsion. There have been two entirely geodetic ships built for the Royal Air Force, the Vickers Wellesley and the new Vickers twin-engined midwing bomber, which, at the time of writing, is unnamed and which made its first public appearance at the Royal Air Force Display at Hendon Aerodrome on the 27th June.

Performance Improved

Calculation shows that if the load of the Wellesley were devoted entirely to fuel, a distance of 8,000 miles could be flown non-stop in still air, or much greater than the existing world's record. A direct comparison with a machine of normal construction shows that geodetic construction enables the useful load to be increased by 500 lb., the top speed from 144.5 m.p.h. to 183 m.p.h., the service ceiling from 17,200 ft. to 21,400 ft. and the range from 550 miles to 1,360. At the other end of the scale, the landing speed goes up only from 58 m.p.h. to 58.5 m.p.h. In other words, range has been increased 2.44 times and performance in general has been advanced with but negligible increase in landing speed.

It is worth recalling that the Fairey Monoplane (Napier engine) that was especially built for maximum range, but constructed along conventional lines, was designed for a range of 5,500 miles, then about the limit of possibility. Mr. Fairey said at the time (1929) that retraction of the undercarriage would have increased the range by about 1,200 miles. The geodetic construction has enabled a machine to be built, not specially for range, but for Army cooperation duties, which puts the whole matter into a different perspective, and which enormously raises the figure then regarded as the absolute limit of possibility.

Two more features of geodetic construction remain to be examined: its ability to meet the modern demand for glossy wing and fuselage surfaces (a demand which has resulted from in-

vestigations into the effects of rough surfaces upon the boundary layer), and its suitability for mass production.

So far, fabric coverings have been favoured for geodetic airplanes. They may be applied directly to the geodetic members or to light stringers laid on top of them. But metal or plywood coverings can be used equally well. Mr. Wallis has devised a system for attaching the fabric which, in conjunction with suitable lacquers, enables a highly polished surface to be obtained. The new Vickers twin-engined bomber has a surface which, although showing the ridges where the stringers go, is as smooth as that on stressed skin all-metal machines.

For quieter ships

An incidental advantage of the geodetic system is the reduction of flight noises. It seems that the geodetic web is not resonant and that it acts as a deadener to sound.

As for the system's suitability for mass production, methods have been evolved which I need not go into here. It seems certain that if the geodetic construction exhibits no unsuspected faults, and if it gives the performance gains which calculations and the early test flights of the Wellesley and the twin-engined bomber indicate, methods will be developed for producing it quickly and in quantity. Already Mr. Wallis has devised special means of constructing fuselages and wings on a series production basis.

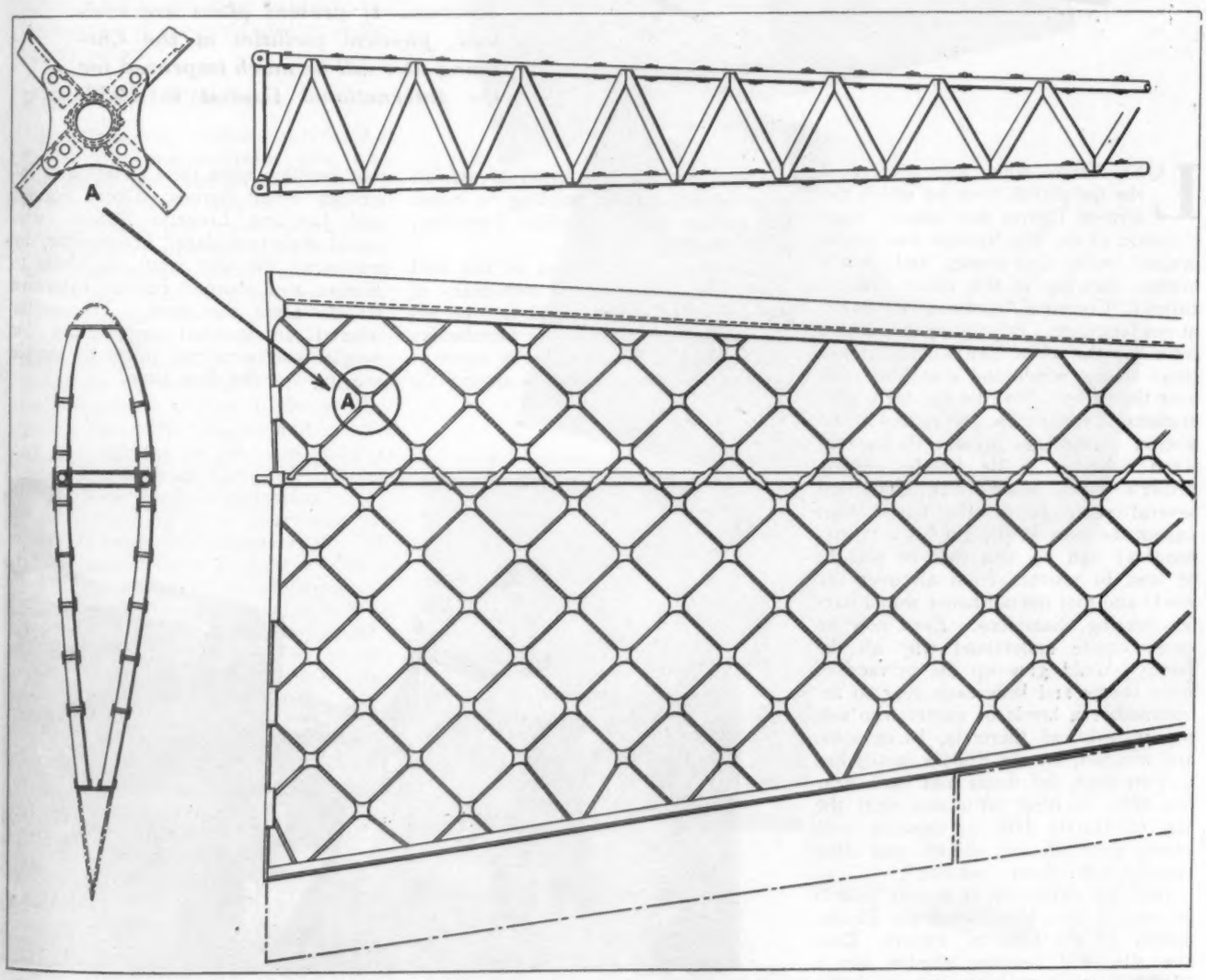
Other advantages

Certain other possible future advantages of the method have been foreseen. For example, the emptiness of the inside of the wing would enable a telescopic form of wing to be employed. A wing of variable area would then become possible.

Another advantage to be derived from the "emptiness" of the wing or fuselage is the increased facilities for housing crew and passengers.

So many and so marked are the advantages offered by the geodetic construction, that one begins to wonder whether there is not a catch in it somewhere. All that can be said at present is that no signs of any unsuspected difficulties have turned up. There have been, as there must be in all new things, many minor difficulties, but nothing has occurred which tends to invalidate the theory or to cast doubt upon its possibilities. All the flying that has been done, and all the calculations and testing, including the load testing at Farnborough, have gone to bear out the inventor's claims. The order by the Air Ministry of the Vickers Wellesley in quantity is proof.

It has been suggested more than once that the Wellesley should make an attempt upon the world's long distance record. Even if no attempt on the world's record is made, the experience of the Royal Air Force squadrons which are to be equipped with the Vickers Wellesley should provide sufficient data to prove the claims that have been made.



Section of a typical geodetic wing structure showing construction details at intersection of members. The diagonal members appear straight in plan, but are actually curved to follow the surface contours.

AVIATION

Records fall in

353 Hours of Soaring at Elmira

Wind and weather conspired to make this year's Elmira meet the most active and interesting contest so far staged by the Soaring Society of America. If present plans are realized, physical facilities at the Chemung sites will be much improved for the International Contest in 1937.

LONG before white men discovered the delightful river on which the city of Elmira now stands, some chieftain of the Six Nations was so impressed with the strong and steady breezes blowing in the valley that he called it "Chemung," meaning "big horn" in our language. Little did he dream that some day the white men would harness those strong winds and soar like birds over the valley. Nor did the early generations of white men who settled in the district foresee its present distinction. Even Grandpa Willie Rhodes, whose father's farm house was completed several years before the Civil War, (about the time Willie got his first suspenders) had no idea that he was to be host to visitors from all over the world and that the old house would harbor soaring champions. Even now he cannot quite understand why all the family should give up the privacy of their rooms and beds each year to accommodate a horde of guests who talk continuously of thermals, barographs, and winches, for the Rhodes family has thrown open the doors and each year fills their inviting farmhouse near the top of Harris Hill to capacity with pilots, meet officials, editors, and other curious folk, from "outside."

And the ownership of Harris Hilltop is soon to pass along from the Rhodes family to the City of Elmira. Thus the site will become eligible for a $100,000 improvement program under W.P.A. Foundations already have been laid for the Warren Eaton Memorial, —an administration building to house the various meet activities (weather, press, medical, etc.).

This year the activities on the field were housed in tents, as were many of the contestants who could not be accommodated at the nearby farmhouses and wished to be close to the scene of activity. Greatest travelers among the tent dwellers were the Californians, including Fred Barnes, Albert Slatter, and Jay and Lucretia Buxton, who towed their two place "Transporter" by trailer all the way from the Coast to Elmira and planned further extensive travels after the meet. Transporter offered an unusual opportunity for people who were not pilots to sample soaring for the first time.

In earlier winches the operator's back was turned to the glider and a pen knife was used in emergencies.

Other new ships at the meet included two of German make which arrived in this country shortly before the opening. One, the Goeppingen I, was flown by Richard C. du Pont in several notable flights. The other, the Rhon Bussard was operated under the sponsorship of the Elmira Association of Commerce.

Two way radio communication experiments were staged on several occasions by members of the Elmira Amateur Radio League, which is advocating that all soaring machines be equipped with radio to facilitate communication with headquarters. Most successful of the experiments was one in which conversation was carried on between the hill station and the "Transporter" soaring at an altitude of 3,000 ft.

A meteorological innovation were the radio balloon meteorographs used by Dr. Karl Lange, director and chief meteorologist at the meet. They were used at Elmira for the first time in routine weather forecasting and performed satisfactorily. This type of meteorograph is a small radio equipped balloon which broadcasts altitude and temperature at one-minute intervals during its ascent.

Winches and Winchmen

Four launching methods were used at Elmira this year—airplane tow, auto tow, shock cord and winch. The first three are generally familiar. The last is a comparatively recent development in this country although it has been used with differences in detail in Germany. It has not been used extensively at earlier national meets but has been exceedingly popular in the east where there is considerable gliding activity under the sponsorship of members of the Associated Gliding Clubs of New Jersey, Inc. The designer and operator of the Elmira winch was Gustave Scheurer of Jersey City, vice-president of the New Jersey organization.

Winch towing offers interesting possibilities because it eliminates the difficulties and risks of airplane and shock cord launching and the preparation of hill surfaces for auto towing. Wear and tear on the tow car and personnel is a serious problem in operating at high speeds over the rough ground so often found at soaring sites.

The Elmira winch was not of the one-man type developed last year by the Newark Glider Club but was an improved version of the earlier automobile types that have been used so extensively. Major improvement is the reversal of position of the automobile so that the operator's back is no longer turned toward the launched glider. The 1,500-ft. rope passes from the rear wheel drum through a hand operated guide to insure even coiling. A second guide on the front fender is fitted with a knife

How the new winch worked. Top to bottom. The operator is holding the emergency release. Closeup of the knife mechanism to cut the rope if the glider release fails. Winchman Scheurer operating the coiler during a launching. Detail of drum showing the slow-speed starting groove.

Photos by AVIATION

Chester Decker, champion of the meet.

safety device to cut the rope instantly if the release on the glider should jam. The drum has a deep groove at the outer end to provide slow speed and greater power to overcome starting inertia.

The success of the 1936 contest has crystalized plans for an international gathering next year at Elmira. Invitations will be sent to all member countries of the Istus (international commission for the study of motorless flight), as well as to Russia and Japan who are not members but have been developing soaring activities. It is believed that important records could be made by American and foreign pilots because of the unique meteorological conditions in this country which are believed to be superior to those of Central Europe. Richard C. du Pont will go to Germany and Mrs. Warren E. Eaton to England as members of a new planning committee of the Soaring Society to make the arrangements.

Flights and Records

Although the meet got off to a slow start its opening days were featured with greater activity than those of the last year's contest. Most of the important records were made, however, during the closing week-end of July 4-5.

The prize-winning and other outstanding flights this year follow:

Greatest airline distance (14.6 miles), which carries with it the gold cup and $500 of the Vincent Bendix Trophy, Chester J. Decker, who also won the lion's share of the A. Felix du Pont prize of $1,500 for greatest number of points, and the Edward F. Evans Trophy signifying national championship.

Greatest altitude, and the A. Felix du Pont prize for first to exceed the national record, Emerson Mehlhose, 6,516 ft.

Duration (made in the Buxton 2-place), Jay Buxton and Albert Slatter, 8 hours, 48 minutes.

Barograph, donated by Mrs. Warren Eaton, for greatest distance and return, won by Richard C. du Pont, with a flight of 18.5 miles and return.

Toledo Glider Club Trophy and $50 for greatest airline distance with a utility, to Henry Wightman, 135.5 mi. His ship won the Wightman Trophy and $50, donated by his mother, for greatest cumulative distance with a utility (187.5 miles).

Total time for the meet came to 353 hours, 49 minutes, and aggregate distance, on flights exceeding the 5-mile point-award minimum, totaled 1,283 miles.

The sixteen days of the meet saw 372 take-offs.

9 A.M. pilots' meetings were addressed by these officials. Left to right, Earl Southee, Charles H. Gale, Arthur (Larry) Lawrence, and Dr. Karl Lange

Groomers of champions. The Rhodes family who furnished food and lodgings for many of the contestants.

How one manufacturer saves SPOT CASH by spot welding aluminum alloys in production

By C. Weston Steward

Chance Vought Aircraft
Division of United Aircraft

SINCE October 1, 1935, the Chance Vought Aircraft, Division of United Aircraft Corporation, has been making an average of more than 12,000 spot welds a day with aluminum alloys. The equipment was designed principally by Mr. D. I. Bohn of the Aluminum Company of America (See AVIATION, August, 1934), in collaboration with engineers from Chance Vought, Westinghouse, General Electric and Federal Machine and Welder Company, and was built by the latter company at their plant in Warren, Ohio. It was installed the latter part of September, 1935, and was immediately put on production work with two shifts a day. The welding machine has a throat depth of 36 in. and produces a maximum welding current at the electrodes of 36,400 amps. The nominal rating of the welding transformer is 300 kva., but it has a peak rating of over 600 kva. The timing control is a Westinghouse electronic type known as the Ignitron which has no contactor or other mechanically moving parts in the actual timing circuit. Control from ½ cycle (60 cycle a.c.) to 10 cycles is available. Welding current is controlled by means of an auto-transformer provided with 40 tap changes. Electrode pressure is supplied and controlled by air pressure. An automatic valve maintains the pressure at a constant pre-set value. The machine is operated by a foot switch which, through a system of relays in the General Electric sequence panel, operates a solenoid air valve. This valve in turn admits air to the cylinder and brings the electrodes together. When the maximum desired pressure is reached, a pressure operated switch fires the large, mercury pool tubes allowing the welding current to pass. When the tubes quit firing another set of relays releases the pressure and opens up the electrodes ready to start again. The whole sequence takes something like one-half second, depending on the adjustment of the apparatus.

Heat-treated aluminum alloys up to ⅛ in. thick can be welded with the arms set at a 10 in. gap, and, with either a 20 in. gap or with the vertical arm in use, the machine will handle 1/16 in. material.

Production Problems

With accurate equipment available, as described above, the first major problem in producing satisfactory welds in production was taken care of. This provided accurate control of three of the variables involved; welding current, time, and pressure. This accuracy is important, as work turned out on equipment previously in use proved to be erratic and made spots which looked good externally, but when studied micrographically were found to be irregular in shape and size. A comparison of specimens made on the two machines is shown in an accompanying picture.

The second major problem was to develop good operators. No matter how good the equipment, a poor operator can make satisfactory production welding impossible. The most valuable asset for a prospective operator is willingness to follow instructions. Previous experience with spot welding of steels is more likely to be a handicap than a help. Of six men who have been trained by the author at Chance Vought and Sikorsky, the four who made good had no previous experience with spot welding of any kind.

The first step in training a new man is to demonstrate to him the difference between a good spot and a bad one, and to explain what conditions cause poor welds. Once he is acquainted with the basic principles, he is allowed to try a few samples and see for himself how they work out in practice. He is then put to work as a helper with an experienced operator and gradually allowed to take over production work —starting, of course, with small, simple pieces. When he is ready to be released, full time, on production work, he should be cautioned that quality is far more important than speed. Speed is something which will develop naturally as a matter of practice. Close supervision is desirable for some time to make certain that he is handling all types of work properly. Even with experienced operators, the author finds it necessary to make corrections in technique from time-to-time, although lately it is more because of changes conforming to research developments than for any other reason.

To eliminate "buck passing" when any poor work is done, it is advisable to provide each operator with a rubber

stamp and require that each man stamp his work immediately after welding.

Surface Conditions

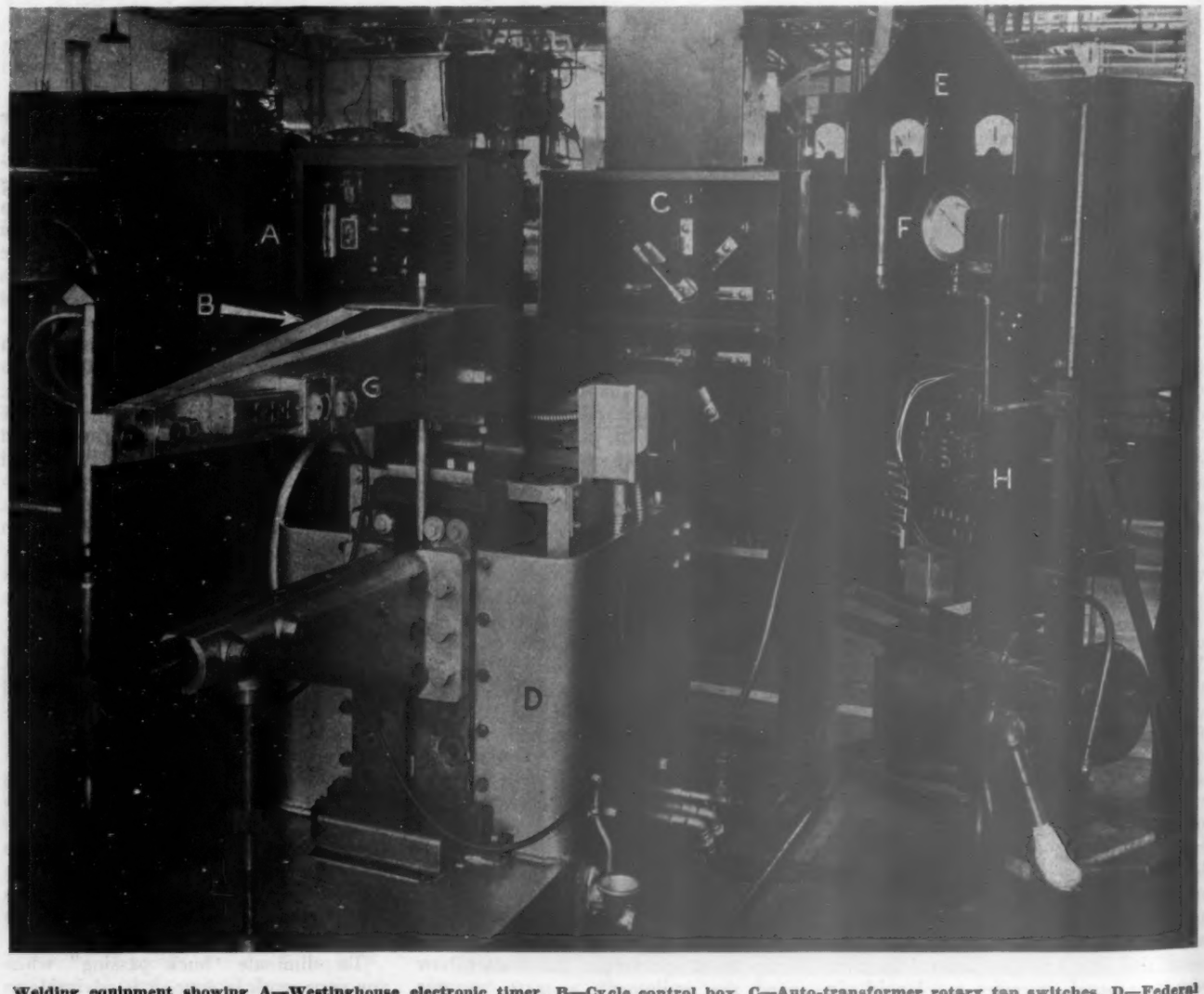
Even with good equipment and well trained operators difficulty was encountered with certain parts which had been heat treated in a salt bath, or had been made on the drop hammer. Up to that time only the external surfaces were being cleaned before welding, in accordance with the best information then available. It soon became apparent, however, that surface conditions were so variable that no two pieces could be welded with the same set up and get anything like the same results, except on test pieces. From data obtained from the Boeing Company and Wright Field (Report M-56-2597), it was known that cleaning all four surfaces gave more uniform results. A few experiments proved further that regardless of the type of heat treat, all surface resistance conditions could be reduced to a constant if all four surfaces were thoroughly cleaned by wire brushing. Thereafter everything was cleaned, whether it was "as received" Alclad or heat treated in a nitrate salt bath. This proved to be the turning point, as it were. Some parts which had practically been given up as incapable of being spot welded are now being done satisfactorily. The extra cost resulting from cleaning is more than offset by the saving due to the greater variety of parts that can be welded and the fact that more spots can be made without cleaning the tips.

Wire Brushing

Cleaning is done with a small rotary wire brush driven by a small air drill. (See cut.) The brush is 2¾ in. in diameter and is stiff enough to remove the high resistant films, but does not remove the pure aluminum coating on Alclad. In the welds illustrated, the pure aluminum layers are still intact although these specimens were cleaned in the above manner. A fair job can be done with fine emery cloth or with Aloxite, or equivalent, but the welding tips will need more frequent cleaning than with the wire brushing method.

At Chance Vought, it is the practice to have the faying surfaces cleaned by the men who assemble the parts. The external surfaces are done by the operator's helper just prior to welding. The operator is held responsible for all surfaces being properly cleaned, as he is the last man to see the work before it is welded. He is, therefore, authorized to refuse to weld any parts which he believes are not properly prepared. This is understood by the entire shop. After a few pieces were refused on this basis and the rest of the shop knew what was expected, this system worked smoothly.

While on the subject of surface conditions, it is worth mentioning that there is a pronounced difference in the number of spots that can be made without cleaning the tips when Alclad is used instead of non-Alclad alloys.



Welding equipment showing A—Westinghouse electronic timer, B—Cycle control box, C—Auto-transformer rotary tap switches, D—Federal Welder, E—Ballistic ammeter, photo-electric eye and d.c. indicator, F—Electrode pressure gage, G—Main line clear out switch and switches to raise and lower the upper arm, H—Sequencing relays.

The ratio is approximately ten to one. Furthermore, Alclad can be satisfactorily welded a number of days after cleaning, while heat treated, non-Alclad alloys turn dark rapidly, requiring a second cleaning or else a still further reduction in the number of spots without dressing the tips. It has also been found that more time and effort are required to properly clean the non-Alclad alloys.

The first consideration in designing special electrodes is to provide good electrical conductivity. Almost as important, however, is rigidity. Deflection of the welding tips under pressure cannot be tolerated except on one condition; that they deflect equally. Unequal deflection causes slipping of the tips and makes a bad appearing spot. The best, commercially available tip material seems to be Elkaloy, which has an electrical conductivity of about 85 per cent of copper and has the physical properties of mild steel. Its chief drawback is the fact that it cannot be brazed or soldered without destroying its desirable properties. Consequently, special electrodes must be almost entirely machined. Tips should not be made with bottle necked shape; i. e., with sudden changes in section, as such conditions tend to make the tip "hot" and will cause surface burning of the spots. Of course, water cooling is essential with aluminum welding as the welding current is high. In fact, production work requiring high amperage and long timing may heat up the main arms of the welding machine. Care must be taken to keep all bolted or clamped electrical connections clean in order to keep heating to a minimum.

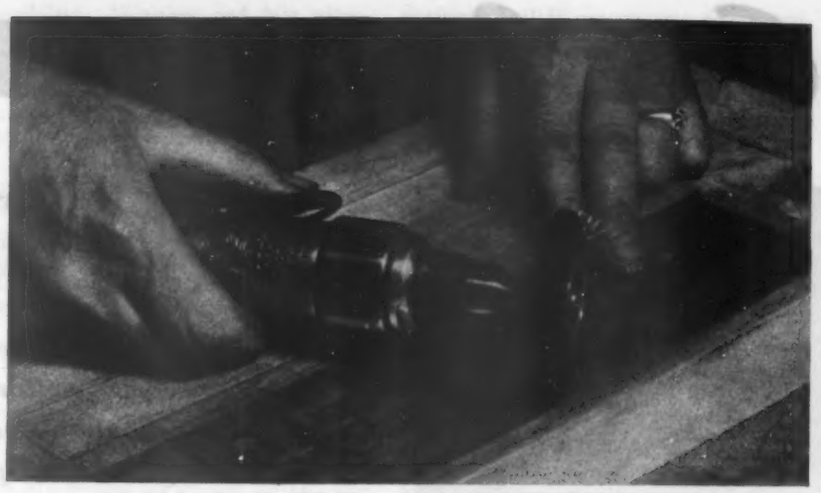
Welding Technique

No attempt is made here to present curves showing weld current, time of current flow and electrode pressure with relation to thickness of material. It has been found that the best practice, so far, is to record settings in a notebook. There are so many variables involved that tabulating or plotting of curves to cover all possible combinations is too involved and too confusing for the average operator. In addition to the above mentioned variables, are added almost infinite combinations of different thicknesses, different alloys, soft materials, heat treated materials and smooth outer surface requirements; all requiring different set-ups. The author has found, however, that the only variable which is critical for all these conditions is the amperage. At present, the time of current flow is kept constant for all work. The pressure and amperage settings are adjusted to suit the conditions.

In the earlier stages the author had conformed to previous information that the best tip shape was a 7 deg. cone and that this shape had to be carefully maintained. With the system now in operation, it has been found that a slightly rounded tip is perfectly satisfactory and is the more natural shape for the operator to maintain thus obtaining longer life from the tips and a higher rate of production. It is important that the tips be cleaned when the spots begin to show specks or small brownish spots instead of being smooth and clean. It has been found that in the thicker gages, however, that it is impossible to eliminate small splashes when the heat is high enough to produce the proper strength. These splashes are a surface condition only and will occur even when the bubble is well below the surface.

The thicker gages in the heat treated alloys present another difference compared to the thin gages. Test pieces pulled apart in the customary manner will not usually pull a button, but on the contrary, will break the bubble in two, showing the crystaline internal structure. This condition begins at about .051 in. thickness. The fact that a button is not pulled does not necessarily indicate a poor weld. The soft alloys will continue to pull buttons even in the heavier gages.

Normally, in production, about 100 spots can be made without cleaning the tips and frequently as many as 200. Tip life is affected chiefly by the cleanness of the work and secondly by weld amperage; the cleaner the work and the lower the current the longer the tip life.



Rotary wire brush and air drill used for cleaning welding surfaces.

Micrographs of spot welds made in .032 Alclad 24 ST, Mag. 2½x. Specimen A was made on the original equipment. Specimen B was made on the new equipment described in this article.

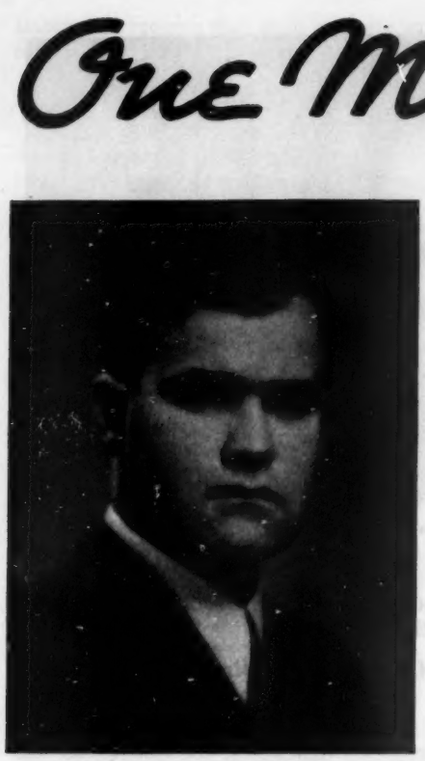
Cost-Spot Welding vs Riveting

The chief advantage of spot welding is low cost compared to riveting. Rivet cost is difficult to determine as the work is not all done at one place by one group of men. Different kinds of rivets are required for different places. Drill breakage is not classified as so much for drilling bolt holes and so much for drilling rivet holes. The same is true for the use of electric drills. Some rivets are headed up by hand, some with guns, some with hand squeezers, some with power squeezers and some with Thompson machines. The best available figures, however, indicate a minimum average cost of 3 to 4 cents per rivet.

On the other hand, spot welding cost is easily calculated. The labor can be figured directly as the time put in by the operator, plus that of the helper, plus that required to clean faying surfaces, which closely approximates the helper's time. Electrical energy is directly proportional to the product of weld amperage and time plus a constant daily wattage to operate the control cabinets. Tool cost is uniform and easy to compute. A magnetic counter records the number of spots per day. Thus all elements of cost are easily accounted for. In terms of percentage of the total they are: Labor, 85 per cent; electrical energy, 7 per cent; tools, 8 per cent. With everything but first cost and depreciation included, spot welding costs less than 3/10 of a cent per spot based on 6,000 spots per eight-hour shift. Thus, it may be assumed that there is a saving of some 3 cents per spot, or, if spot welds are spaced closer than rivets, at least 2 cents per spot.

[In a later article the author will discuss further the technique of making spot welds of improved quality in aluminum alloys on a production basis.—Ed.]

One Man AIRLINE



By Rodney H. Jackson

Vice-President and General Manager,
Hampton Air Service

With feeder line development the next important job for fixed base operators to do, it should interest them to know how one man gets $1500 per month gross out of a Stinson Reliant during the summer season

THIS never would have happened if Manufacturer Louis Root had not been a lover of nature and enjoyed the birds and flowers in the garden of his Southampton (L.I.) estate. But he did, and accordingly he set about to find some way of traveling back and forth between his New York office and his summer home a hundred miles away without wasting most of his business day in the process. Then he met the author, and in 1935 there began a series of studies of the problem which led to the inception of a one-man airline competing with the "Cannonball," fastest commuter's train connecting New York and Southampton.

The result of the first year's operation was so successful that service was resumed and improved this summer, with the hope of making it a financial as well as an operating success.

Five mornings a week the five-place Wright-powered Stinson leaves the country at 8 and lands its passengers at Holmes airport in New York at 8:40. Taxicabs meet the plane for the ten-minute run to Queensborough Plaza, whence a 5-cent fare carries passengers to any point in the city served by the three subway systems. One hour and fifteen minutes from home doorstep to city desk in uptown New York, and about ten minutes longer for the Wall Street district, is a clear saving of an hour and a quarter on each trip compared with the "Cannonball." In the evening, passengers leave the Plaza by taxi at 5:17; the plane takes off at 5:30, with a 35-minute schedule eastbound to Hampton Airport, beating the train which left the city at 3:55.

Hampton Air Service, Inc., whose one airplane is bringing in a gross revenue of over $1,500 a month during the summer, is an example of what a one-man airline can be made to do. The pilot goes by the title of vice-president and general manager, and as such divides his time between managing the local Hampton Airport, which is operated directly by the company, and conducting the airline.

The payroll is limited to the pilot-manager; a licensed mechanic and two or three helpers, who take care of maintenance and do work for the many private owners who visit or base at the field; and a secretary-hostess, who also divides her time between the airline and other more general airport duties. Passenger booking is handled through hotels and real estate offices in Southampton, on a 10 per cent commission basis, and through Air Line consolidated ticket offices and Mr. Root's business office in New York. This arrangement saves a good part of the traffic overhead of office rents and salaries with which a larger airline must be burdened.

Long Hours

The general manager must get up early in the morning to perform the varied duties of the many employees of a more pretentious organization. First he makes a 6:15 a.m. weather forecast from radio reports, from WWU at Elizabeth, N. J., and from local conditions; he acts as plane dispatcher, basing his decisions on his own forecast; he supervises maintenance and is responsible for seeing that the mechanic and helpers keep the airplane spotless and in perfect operating condition; he directs traffic and traffic promotion, spending every day in New York from 9:30 to 5 handling correspondence, at the telephone, or making personal calls to solicit business, and he pilots the airplane. In the evening he becomes the director and goes over the necessary reports and other paper work with the secretary, checking the accounting, and gloating over the day's cash receipts.

Both airplane and pilot are available for charter flights out of New York City during the day, and from Hampton Airport in the early morning, late afternoon, night, and on week-ends, so far as they can be arranged without interrupting the daily schedule. About 50 hours of such flying is anticipated for the 1936 season at 20 cents per mile, which equals about $28 per hour. This is an important addition, both to income and to building up total airplane time in order to cut the fixed hourly costs.

During the four-months' period from the first of June to the end of September last year, Hampton Air Service records show 151 flights completed out of 167 scheduled (performance average, 90.42 per cent) and a total of 257 passengers carried. The 110 hours of flying on schedule was augmented by 143 hours of charter, solo, and personal trips by Mr. Root so that the cost per airplane-hour was reduced to the neighborhood of $18. The slightly larger, 25 m.p.h. faster, and more expensive Stinson now being operated is costing about $25 per round trip to New York of one hour and fifteen minutes, so that a 50 per cent increase in passenger revenue over last year will provide free daily air commutation to the backer of the project and will actually return a net profit for the season. With only a small four-passenger airplane it would still not be possible to make a profit on an annual basis, however, for without frequent private use of the airplane the weight of fixed charges during eight months of inactivity would have to be overcome by a profitable busy season.

Rates for the 82-mile flight have been established at $7 one way (a reduction

of $1 from last year), $12 round trip, with a 30-day limit, and $5 per trip on a twenty-trip ticket which sells for $100. The latter equals 6.1 cents per mile. Although none of these tickets were sold last year, several of last summer's occasional patrons have returned to purchase them for the present season. The ticket, which is punched when presented at the airport, may be used by any member of the family or his guest, with the simple provision that no ride be resold.

When a second full load can be booked, especially on Friday afternoons when everybody seems in such a hurry to leave the hot city, an extra schedule at 4 o'clock is run with the Stinson, or an outside plane may be chartered for a second section at 5:30. Four one-way tickets cover the cost of deadheading this extra back to New York, and when four season-ticket holders are carried, bringing in only $20, the loss is charged up to creating good will and building up the business.

When the fog rolls in

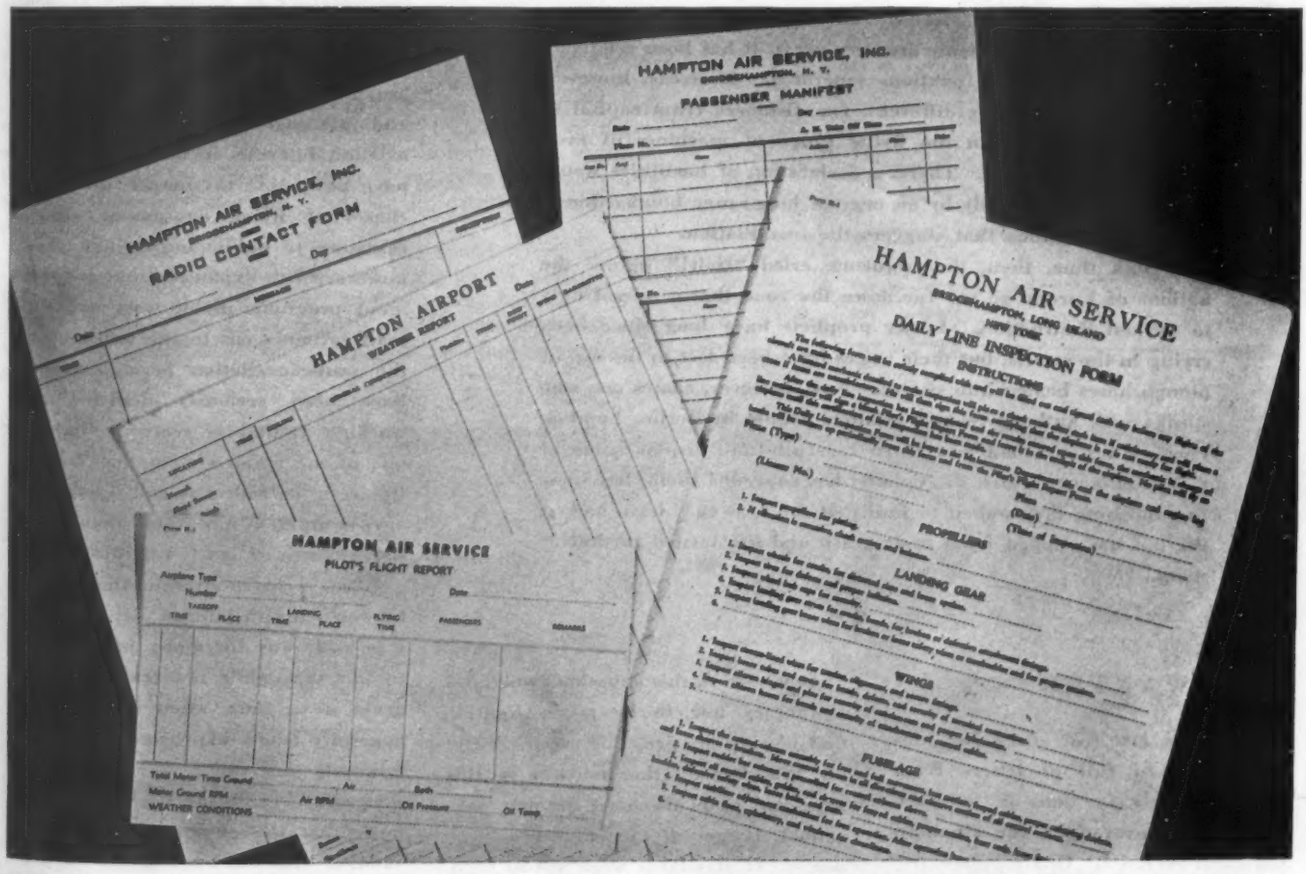
The principal operating difficulty lies in a local weather condition peculiar to the south shore of Long Island, making accurate forecasting a real difficulty and 100 per cent regularity a practical impossibility. Morning and late afternoon fog, several hundred feet thick, rolls in from the ocean fairly often in June and early July, and with a single-motored landplane no flights are attempted without an assured 500-ft. ceiling. The terrain along the airline is fairly level with two large intermediate airports, but generally when ceilings are under 1,000 ft. an alternate route is flown, following the outer beach along Great South Bay, practically a continuous emergency landing strip.

Use two way radio

Two-way radio is carried, although there is no ground station at Hampton Airport. The airplane transmitter is used to give periodic position reports which are picked up by the airport all-wave receiver, as well as to request special weather reports from Newark when necessary. The additional safety which radio gives in doubtful weather is realized and appreciated by the passengers.

When a morning or afternoon forecast indicates probable or even possible inability to complete a scheduled trip, passengers are notified of the fact by telephone by the pilot long enough in advance to take trains and still reach their destination in time for previous appointments. On only one occasion during the 1935 season was a trip cancelled without giving advance warning.

In addition to personal calls on prospects in their homes and offices, a mail advertising campaign has been directed at the 300 or 400 wealthy summer cottagers in the Hamptons, stressing the point that it is actually less expensive to commute daily by air at $50 per week than it is to maintain a town house or apartment in the city throughout the summer, going down to visit the family only on week-ends. If this campaign produces sufficient support, Hampton Air Service will operate a ten or twelve-passenger multi-motored airplane during the 1937 season. A large seaplane or amphibian to the city-owned landing at the foot of Wall Street would also give many obvious advantages over the present service. But it may be seen that such an expensive service, for only four summer months, could be safely started only after several season tickets for *daily* seat occupancy had been assured. In the meantime, a one-man airline is actually running back and forth, getting operating experience over the route and testing operating practices, with a degree of regularity and safety that is building up public confidence to the point where a much enlarged service may be supported.



Line Inspection Form filled out daily by licensed mechanic. Plane can't be flown unless a Pilot's Flight Report, signed by mechanic after line inspection, is in ship. It is filled out and signed by pilot and returned to mechanic at end of day. Passenger Manifest, made out 24 hours before each flight, and checked by mechanic's helper (uniformed) at departure. Early morning weather observations are recorded on Weather Report Form and given to pilot on his arrival at the field. On the Radio Contact Form are recorded reports and messages received and transmitted in scheduled flight.

Editorials

AVIATION • ESTABLISHED 1916
VOLUME 35, NUMBER 8

WITHOUT ARMOR

▶"We in aviation carry a heavy responsibility. . . . We have stripped the armor of every nation in war. . . . We can no longer protect our families with an army. . . . Every institution which we value most is laid open to bombardment."

Thus Charles Lindbergh, in the role of a modern Luther, nailed to the door of official Germany a warning that the whole world would do well to heed. Simply and sincerely, he put into plain language facts at which diplomats and military brass hats have boggled for the last ten years. His speech in Germany will go down as one of the high spots of a distinguished career. It may well prove to be a turning point in the history of international relations.

The facts are not new. Those of us who have watched the evolution of the airplane over the last twenty years have long been aware that it is the most potentially dangerous weapon that has ever come to hand. As a defensive tool it is without equal. Unfortunately, it is, at the same time, an offensive arm of the first order. Here in America, where air distances to the nearest probable enemy are very great, it has been relatively easy to keep the two functions separated. Overseas, however, the situation is entirely different, for distances from capital to capital are well within the flying range of machines of even mediocre performance. There, a declaration of hostilities would be followed immediately by an orgy of long-range bombardment of civil populations that staggers the imagination.

High time, then, that someone cried "Halt!" before the nations of Europe go too far down the road that can lead only to mutual destruction. Lesser prophets have long since been crying in the streets, but their voices have been lost in the din of ploughshares beaten into swords. Now, however, comes one who speaks with authority,—and aviation people in Berlin, London, Paris and Rome had best listen carefully and display some of that intelligence which the Colonel has conceded them, lest some fine morning they waken to find that the bear they have had by the tail has slipped from their grasp and has turned to destroy them.

MEN WANTED

FOR the last five years our files have been full of letters from people looking for jobs in aviation. Now, almost over-night, the situation has been reversed. Our files are filling up with letters from the industry asking for men,—more men.

As we see it, this situation is neither temporary nor to be taken lightly. Considering the probable expansion in all branches of the industry in the next five years the need for new personnel is going to be increasingly acute. If standards were not so high the situation would not be so serious, but aviation needs not only quantity but quality, and the supply of really good men with adequate training is limited.

Fortunately there are a number of excellent civilian aviation schools in the country which are well staffed and well equipped to turn out trained men. It is essential, however, that they be given exact specifications covering the kind of men the industry really needs. Manufacturers and operators alike will find that cooperation with the school people will ease their future personnel problems. Unless they are willing to inaugurate their own training departments, an expensive procedure at best, it is the only way they can be assured of getting the kind of men they need when they want them.

A TIP FROM THE RAILROADS

FOR YEARS it has been common practice for railroads to finance the purchase of rolling stock by issuing trust certificates. Something like a billion dollars worth of certificates are now outstanding covering freight and passenger equipment. So far, aviation interests in the United States have been able to finance their purchases of flying equipment without resorting to public borrowing. Now, however, with expansion and re-equipment programs under way, and with mail revenues cut to the bone during the post-cancellation period, reserves have been seriously depleted and working capital is scarce. Recently one of the major systems has taken a tip from the railroads and is planning a re-equipment program financed by the issuance of trust certificates.

Here is an innovation that should be watched with interest. It may offer a possible way for more than one line to put through a modernization program at a time when revenues are generally below expenses. We hope, however, that the period for such a necessity may be short. We sincerely hope that the airlines will never be saddled with the burden of long-term debt that is the ever-present nightmare of railway operators.

Flying Equipment

What's new in aircraft, engines and major accessories

Ryan's New ST Series

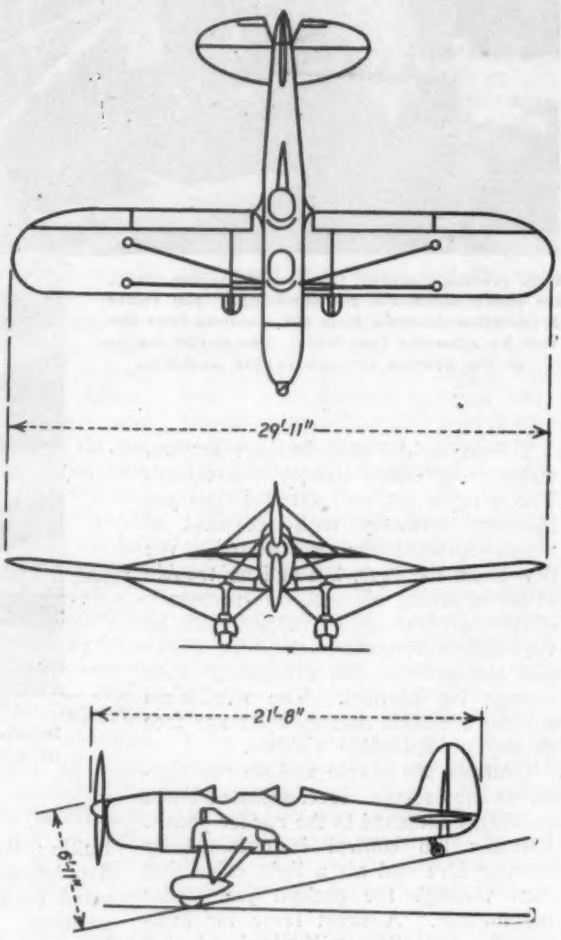
Three ships are offered with Menasco power plants of 95, 125 and 150 hp.

AFTER THE CLOSE of the midsummer ATA maintenance meeting (news Section) we dropped down to San Diego and spent the best part of a day with Claude Ryan and Earl Prudden at their Lindbergh Field base. The Ryan Aeronautical Company shops were busy turning out 1936 versions of the Model ST two-seater. Already they have produced as many ships this year as they did in the entire year of 1935.

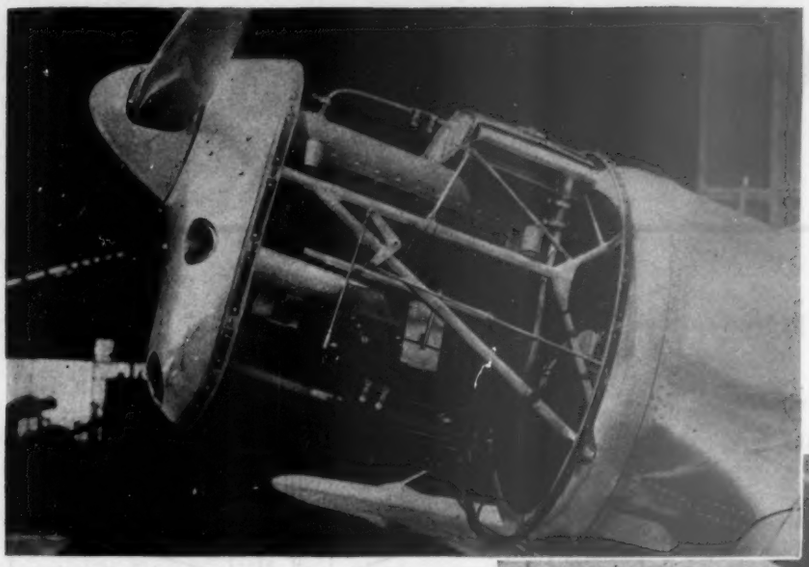
High spot of the visit was a chance to fly the new ST. We went out with John Fornasero, Ryan's chief test pilot. We followed him through for a take-off and a landing, and then tried a couple ourselves which turned out not too badly, considering that we have done comparatively little active flying of late. The ship is a joy to fly. She is light and quick on the controls, but stable enough so that it does not have to be flown constantly even in fairly gusty weather. She made good turns, "feet off," and would fly comfortably "hands off" for extended periods. Fore and aft trim by means of the elevator tabs was found to be very effective.

Lateral control at stall was unusually good. Stalled, power off or power on, the ship responded quickly to lateral stick movements, and showed no tendency to slip off into a spin, right or left. Spin qualities appear to be good regardless of position of the flap. Recovery is quick. As flap is lowered time for recovery decreases.

In landing, with the flap full down, we found no evidence of tail buffeting or blanketing, the ship being under positive longitudinal control at all times. The flap makes possible a steep approach glide. The actual landing speed appeared to be reasonably low, and the ground run, with full brake application was very short.



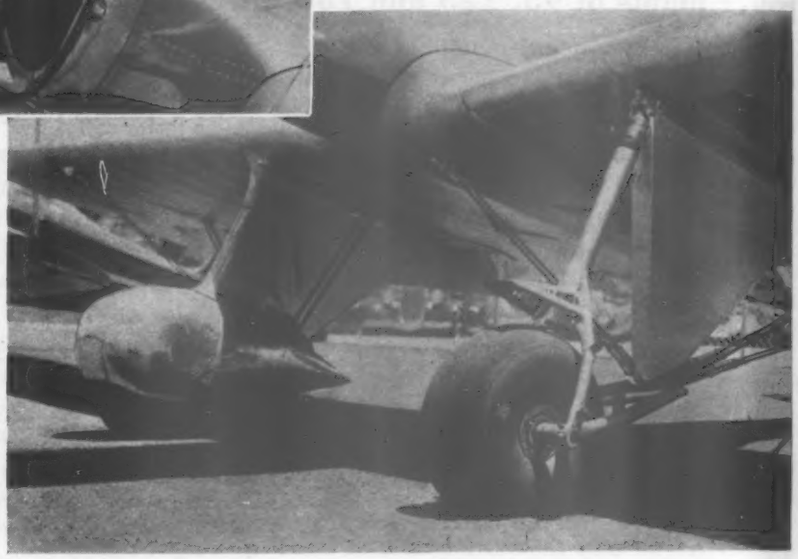
Ryan ST Models for 1936, similar in general appearance to their predecessors, incorporate a number of improvements.



With cowling removed, the Menasco power plants are easily accessible for servicing. The entire installation detaches from the stainless steel firewall by removing four bolts. The engine fastens to the bearers through rubber bushings.

minum assemblies in the ship. It is of a built-up welded sheet steel and carries the front spar fittings as well as the points of attachment for the diagonal wing bracing struts and the upper bracing wires.

The whole engine installation forward of the stainless steel fire wall comes off as a unit by disconnecting four main bolts and the engine controls. This power unit is of simple design, clean cut, and makes the whole engine completely accessible for servicing when the cowlings are removed. A simple modification of the engine bearers takes care of the three alternate Menasco power plants. As a result of continuous research, the 1936 STs have a new type of engine baffling which provides adequate cooling under all possible conditions of outside temperature.



Details of the under-carriage. Goodyear Airwheels are carried on long travel oleos. Of interest is the cluster fitting for the tie-rods. Pants and other fairings are now made of drophammer formed Alclad dural.

Thanks to the oval fuselage section, vision from either cockpit is excellent. The wing is set well aft and does not interfere seriously with the field of vision forward and downward. We flew from the rear, but had no trouble at all in seeing all that was necessary of the ground as we approached by very little movement of the head. Cockpits are narrow, but are plenty wide enough for comfort. The windshield designs are such that cockpits are free of any objectionable airblast.

Controls are simple and do not clutter up the cockpit. Heel actuated brake pedals are attached to the rudder pedals. Elevator tab control is obtained by moving fore and aft a light cable that runs through the cockpit just under the throttle. A short lever for locking the swiveling tail wheel (during cross-wind landings) is located on the floor just beside the stick. Older ST models had the flap control in the form of a short crank located near the floor on the right-hand side of the rear cockpit, but new models carry a direct-acting lever in about the same location. Pulling the lever full back puts the flap full down—throwing the lever forward puts the flap back into normal position. Flaps can be locked in any intermediate position also. The action is much faster than with the older crank-type installation. The seats are of the bucket type arranged to take seat-pack parachutes. They are fitted with comfortable backs and head rests. Instrument board arrangement is simple and efficient.

Tail surfaces are aluminum alloy framed, fabric covered. Elevator tabs give effective longitudinal trim.

Going down the Ryan factory production line, we were struck by the rugged simplicity of the ship in all its parts. The fuselage is of a full monocoque pattern. Skin plating is of heavy gage Alclad riveted to drophammer-formed dural rings. There are no fore and aft members except for a couple of inverted U sections riveted inside the skin running from the upper engine mount connections at the fire wall to points aft of the rear cockpit to carry the loads around the cockpit openings. Most ingenious is the main fuselage ring located just ahead of the front cockpit, one of the few non-alu-

Landing gear of the latest STs is basically the same as for older models. Main wheels are 18x8x3 Goodyear Airwheels with mechanically operated brakes. Shock absorbers are of the oleo type. All bearings are fitted with bronze bushings readily replaceable. Tail wheel is 8 in. in diameter, streamlined, mounted on a trombone type rubber shock absorber. It is full swiveling, with lock controllable from the cockpit. A recent improvement is the manufacture of all pants and fairings of Alclad dural instead of the softer aluminum sheet formerly used. The drop-hammer-formed Alclad is stiff and rigid, and withstands normal wear and tear readily. Pants are quickly removable for wheel and brake inspection.

Wings are of the same general type of construction as former models with solid spruce spars, aluminum alloy

POWER PLANT — MENASCO	S-T B4 — 95 h.p. @ 1,975 r.p.m.	S-T-A C4 — 125 h.p. @ 2,175 r.p.m.	S-T-A- SPECIAL C4S — 150 h.p. @ 2,275 r.p.m.
Wing Span	29 ft. 11 in.	29 ft. 11 in.	29 ft. 11 in.
Length Overall	21 ft. 8 in.	21 ft. 8 in.	21 ft. 8 in.
Height Overall	6 ft. 11 in.	6 ft. 11 in.	6 ft. 11 in.
Wing Area	124 sq. ft.	124 sq. ft.	124 sq. ft.
Propeller Diameter	77 in.	77 in.	80 in.
Airfoil Section	N.A.C.A. 2412	N.A.C.A. 2412	N.A.C.A. 2412
Weight Empty	1,027 lb.	1,027 lb.	
Useful Load	539 lb.	539 lb.	
Gross Load (Maximum)	1,575 lb.	1,575 lb.	1,575 lb.
Range	400 mi.	375 mi.	375 mi.
Maximum Speed @ Sea Level	140 m.p.h.	150 m.p.h.	160 m.p.h. (not yet accurately tested)
Maximum Speed @ 7,500 ft.	128 m.p.h.	137 m.p.h.	148 m p.h.
Cruising Speed @ 2,000 ft.	120 m.p.h.	127 m.p.h.	138 m.p.h.
Rate of Climb (Sea Level)	850 ft./min.	1,200 ft./min.	1,400 ft./min.
Service Ceiling	15,500 ft.	17,000 ft.	21,000 ft.
Landing Speed	42 m.p.h.	42 m.p.h.	42 m.p.h.
Take-off Run — full load	190 yd.	175 yd.	145 yd.

Fuselage construction is simplicity itself. This view shows the section from the rear cockpit to the tail cone. In the upper corners can be seen the U channels which carry the loads around cockpit openings.

ribs, steel compression members and fabric covering. Leading edge is covered with 17ST sheet to a point well back of the front spar. Ailerons have steel tube spars with aluminum alloy ribs, with leading edges covered with dural. They are push-pull tube operated, with differential action. Flaps are of similar construction to the ailerons. By the lever action described, they lower to a maximum of 30 deg. Tail surfaces are constructed entirely of aluminum alloys in the form of tubular spars and stamped ribs. Elevators and rudder are of the same construction. The entire assembly is fabric covered.

In addition to the wheel pants mentioned above, all motor cowling, fillets and other fairings formerly made of ordinary aluminum sheet are now made up from 17S or 24S Alclad, which are considerably stronger and more durable. Alclad shapes do not have the tendency to harden and crack which is exhibited by some of the materials formerly employed. The installation of drop-hammers and of improved sheet metal forming processes have made these changes possible.

An optional feature now being widely used is an auxiliary gas tank which can be placed in the front cockpit instead of a passenger to increase the range of the ship from 400 to 650 miles. This tank can be installed or removed quickly. It is Department of Commerce approved and does not affect the total weight or balance of the airplane. For use with the front seat tank installation, a removable front cockpit cover is available which hinges open for baggage.

Three models are now available all manufactured under Department of Commerce ATC Nos. 541 and 571. The general specifications and performance figures are given above.

Wright Cyclone Series G

New 1,000 hp. engine announcement marks tenth anniversary of Cyclone development

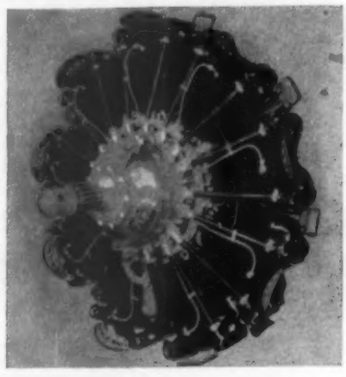
COINCIDENTAL with the tenth anniversary of Wright Cyclone engine development comes formal announcement of the R-1820-G series, most powerful of the Wright line, which is being used in the Douglas Flagships of American Airlines and the Douglas and Boeing bombers now on order by the U.S. Army Air Corps. Early engines in the series have been used in record-breaking flights of Howard Hughes and General Frank M. Andrews of the General Headquarters Air Force. From now on they are to be available for both domestic and export sales.

In the decade of developments which led to the commercial production of the present model, power output has been increased 100 per cent and specific weight reduced by approximately 50 per cent. Specific fuel consumption of the new Cyclone is given as .43 lb. per brake horsepower-hour, at cruising horsepower.

Improvement in sand foundry technique has been one of the most important factors in lifting the limits of performance of radial air-cooled engines. It is through progress in making aluminum alloy castings that it has been possible to produce cylinder heads with cooling fins of greater depth and closer spacing than those of earlier models. The G Cyclone engines have 175 sq.ft. or nearly double the effective cooling area of previous models. The fins have been distributed in such a way as to provide uniform cooling over the entire combustion chamber including the spark plug bosses and the exhaust valve seats, notorious hot spots, and the fins have been carried high up in both intake and exhaust valve regions. A finned spark plug with longer threads, larger heat dissipation areas and improved electrical construction is used, to reduce detonation and minimize the difficulties arising from lead deposits on electric parts.

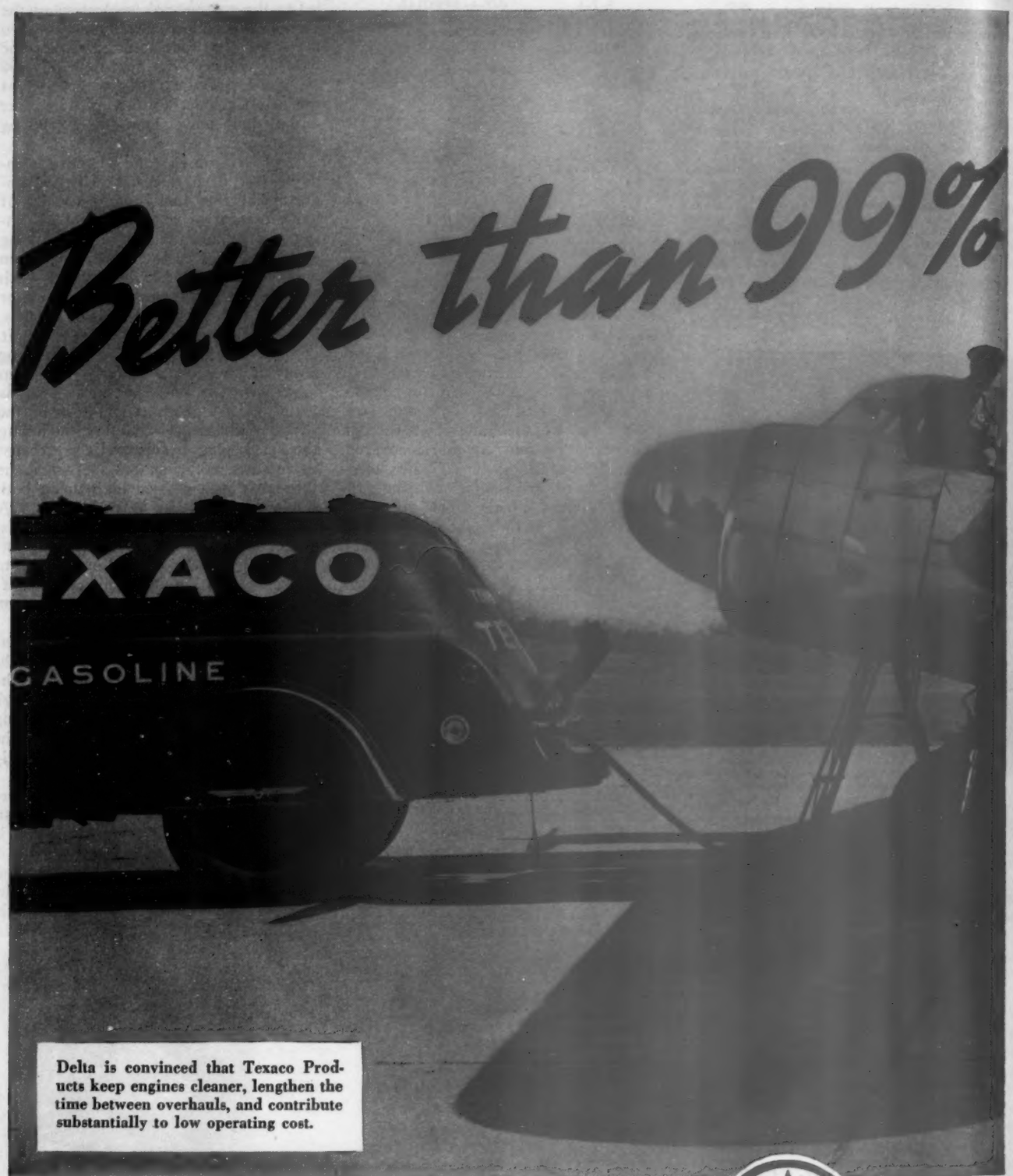
Valve mechanism is completely enclosed in boxes cast integral with the cylinder head and lubrication is of the automatic type. Oil is metered through the push rods to the rocker arm bearing and returns to the engine through the push rod housing, forming a completely internal lubrication system.

Induction passages to the intake valve have been redesigned to reduce resistance to gas flow and temperature rise in the system. Cylinder assembly consists of forged Nitroloy cylinder barrels which are screwed and shrunk into the cast aluminum alloy heads. Service life of the cylinders has been increased by Nitriding the inner surfaces of the barrels.



Largest Cyclone, the R-1820-G.

Sodium cooled exhaust valves are faced with stellite acting against stainless steel seats to resist deterioration at high temperatures and the action of lead compounds in combustion.


Better than 99%
EXACO
GASOLINE
Delta is convinced that Texaco Products keep engines cleaner, lengthen the time between overhauls, and contribute substantially to low operating cost.

TEXACO

TEXACO
Aviation Products

Delta is proving the dependability of these products

FLYING Stinson DeLuxe Low-Wing Transports and Lockheed All-metal Electras, Delta's latest available report shows their routes are operating more than *99% on time.* This is a tribute to Delta operating skill . . . and a tribute, too, for Texaco Aviation Products. Delta has used Texaco exclusively ever since engaging in the passenger transport business.

Thousands of flights have proved to Delta the dependability of Texaco Aviation Gasoline . . . that it is fast starting, quick accelerating, non-detonating . . . powerful. Delta has proved that Texaco Airplane Oils maintain pressures at high temperatures—reduce wear—and are free from sludge and carbon forming elements.

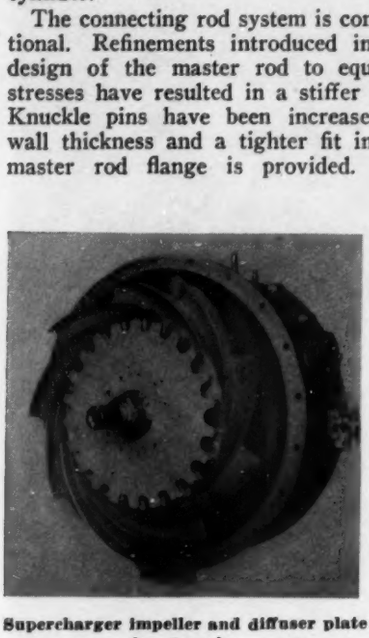
You, too, can get the same dependable operation with Texaco Products because they were refined especially for aviation use.

A Texaco representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

THE TEXAS COMPANY
135 East 42nd St., New York City
Nation-wide distribution facilities assure prompt delivery

Pistons are cross-ribbed on the under side of the head to increase their strength and their skirts are slightly longer than those of previous Cyclone models, to increase bearing surface and reducing the tendency to "rock" in the cylinder.

The connecting rod system is conventional. Refinements introduced in the design of the master rod to equalize stresses have resulted in a stiffer unit. Knuckle pins have been increased in wall thickness and a tighter fit in the master rod flange is provided. Improved seating surfaces for the pins have been obtained by providing a mirror finish in the knuckle pin holes. The crank pin hole in the master rod is also polished to provide a more nearly perfect bearing surface between the rod and the steel shell at the high lead bronze crankpin bearing. Both the knuckle and wrist pin bushings of the articulated rod and the piston pin bushings of the master rod are rolled bronze spun into position. This process increases the strength of the end of the rod by eliminating rivet holes.



Supercharger impeller and diffuser plate for G series.

Excepting minor modifications in the detailed dimensions, the crankshaft of the Cyclone G is similar to that of the F series. An important feature of the crankshaft is the installation of the dynamic damper first introduced in the F-50 Cyclone series. (For details see AVIATION, June 1935.)

Detailed modification to increase strength and withstand higher stresses are the principal differences between the crankcases of the G and F series Cyclones. Excepting the nose section, the cases of the G series are identical for direct drive and geared models. The main section carrying cylinder foundations is in two symmetrical parts, joined by nine through bolts. Main crankshaft bearings and cam drive gear assembly are carried in this section. The nose section encloses the cam mechanism, valve tappets and guides, crankshaft thrust bearings and reduction gearing in geared engines. Oil passages are drilled in this section for valve gear lubrication. The nose section also carries the governor for the constant speed propeller. Immediately behind the main section is the mounting section having nine equally spaced lugs—integral with the case. This section forms the front wall of the supercharger diffuser distribution chamber and carries the tangential ports for the induction pipes leading to the cylinders. In the supercharger section are carried rear diffuser and supercharger vanes as well as carburetor, mounting pads for tachometer and fuel pump, gun synchronizers and the Cuno oil filter. It acts also as a housing for the accessory drive gears whose bearings are carried in the accessory section. An approximately flat plate of magnesium alloy, the accessory section forms the rear crankcase cover. Accessory drive gears, mounted on the forward side of this section, are enclosed in the rear part of the supercharger section, which is separated from the diffuser chamber by integral wall.

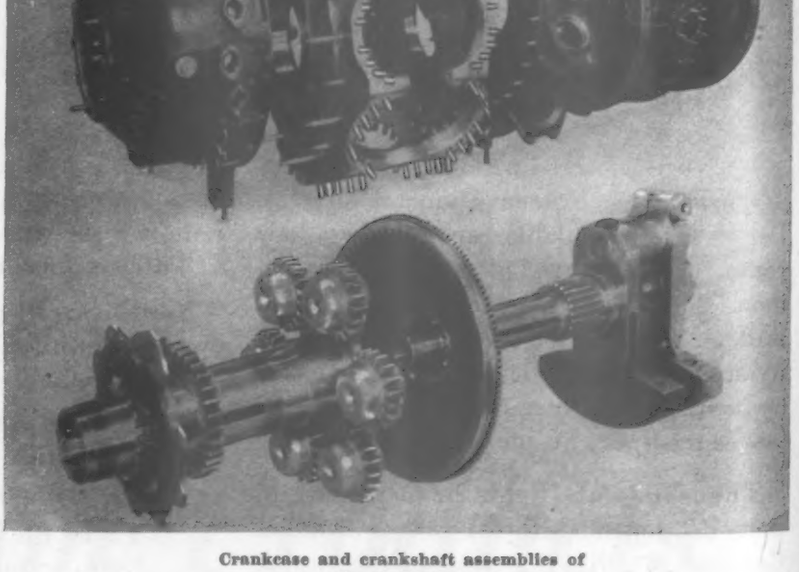
The G Cyclone supercharger is generally similar to that of the F series. Proportional increases in inlet area and diffuser vane dimensions and passages and numerous refinements in contour have been made. Six optional impeller speed ratios are available, ranging from 5.95 to 10 times crankshaft speed.

A down-draft carburetor of materially increased capacity has been developed for the new engine and improved mixture control has resulted in a finer adjustment of fuel air ratio than previously possible. This is accomplished by increasing the effective travel of the mixture control lever. To the mixture control has been added a device which cuts off fuel supply at the carburetor jets instantly to stop the engine quickly without danger of backfire when the mixture control is moved to the stop at full lean position. The flow chamber, however, remains filled with fuel for the next starting. In the throttle control system is an automatic mechanism for maintaining constant induction manifold pressure. It may be set by the pilot for normal operating pressure or for emergency take-off pressure.

Geared models have a propeller speed reduction unit (16-11 ratio) enclosed in the nose section.

Two Scintilla magnetos and the engine oil pump with light vacuum pump drive are furnished as standard accessory equipment. Mounting pads and drives are provided for constant speed propeller governor, two gun synchronizers, starter, generator, two tachometer shafts, fuel pump, angle drive for vacuum pump and generator, or pumps. Accessory gears are driven through a single extension shaft splined to the rear end of the crankshaft and spur gears are used exclusively. The extension shaft is coupled to main accessory drive gear through a special spring coupling to cushion the accessories from acceleration loads.

The main oil supply lubricates all parts of the engine including the valve gear. Full pressure lubrication is provided to all of the main bearings by gear pump. An adjustable relief valve



Crankcase and crankshaft assemblies of the G Cyclone.

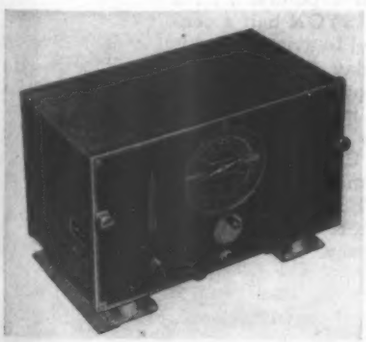
automatically maintains uniform oil pressures and bypasses excess oil to the inlet line. Oil from all parts of the engine drains into a sump between the bottom cylinders. The use of a short tube to lead the oil from the center of the crankpin chamber to the master rod bearing converts the chamber into a centrifuge which removes foreign particles too small to be separated by oil filters.

The piston ring type of oil seal has been applied to the supercharger drive shaft, propeller thrust nut, propeller shaft oil transfer for the hydro controllable propeller, and the cam drive gear oiling bracket. Special oil sealing bushings on the accessory shaft eliminate leakage into accessories.

W.E. Type 20

Western Electric adds another receiver to its aircraft line

BELL LABORATORIES have recently turned out for Western Electric a new lightweight three-purpose receiver, the Western Electric Type 20. This set is a superheterodyne with one stage of tuned radio frequency, two stages of intermediate frequency amplification and two stages of audio frequency amplification. Four separate frequency bands are provided (200 to 400 kc., for beacon and weather reception; 550 to 1500 kc. for commercial broadcasting; 1500 to 4000 kc. for aircraft, police and amateur work; and 4000 to 10,000 kc. for aircraft, amateur and foreign broadcasts).



W.E. Type 20 Receiver

The output is 700 milliwatts. The set is designed so that crystal-controlled reception in either or both of the high frequency bands may be employed, and for this purpose a two-frequency crystal controlled unit is available for incorporation. Convenient facilities are offered for switching from one frequency band to another. The set is available in direct or for remote control.

A device known as the "Varistor" reduces large static noises when receiving weak signals. Automatic volume control is normally used except for beacon reception where it might interfere with the performance of the receiver for course indication.

Including vacuum tubes, the receiver weighs 14¾ lb., measures 9 in. high, 14⅛ in. wide, 8¼ in. deep. It is furnished on special shock absorbing rubber mounting.

Ranger "24"

Improved performance in new Fairchild cabin monoplane

COMPLETELY Fairchild-built excepting instruments, brakes, and tires, the Ranger powered "24" is now being produced at the rate of four per week. Wings, fuselage tail and landing gear are identical with those of the latest Warner "24" and a number of detailed refinements over the previous Ranger model are incorporated.

Cowling has been reshaped for better streamlining, resulting in a shorter and broader nose. The sides of the nacelle are easily removed exposing engine, oil tank, and battery box. The engine mount is unique and follows modern automobile practice. The engine itself is supported on four rubber pads built into the feet and designed to take the engine weight in shear. Torque reaction is taken by an entirely different type of rubber bracing at the rear and lower end of the engine.

Carburetor intake shape and location have been changed to provide a ram equal in pressure to one inch of mercury, resulting in improved performance. The cooling opening on the opposite side of the cowling has been carefully shaped and located to provide maximum air flow over the cylinders through the venturi-shaped opening at the rear. Streamlined into the bottom of the cowling is an oil cooler.

To provide cooling under all conditions a high ratio of fin area to horsepower is used in the design of the engine cylinders. Most of the engine parts are identical with those used in the twelve-cylinder military models which develop 50 per cent greater power. Thus improved reliability has been obtained at a negligible increase in engine weight.

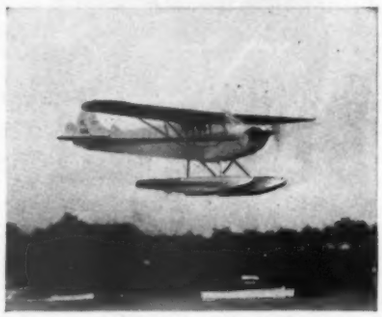
SPECIFICATIONS OF THE NEW RANGER "24"

Weight Empty	1,565 lb.
Gross Weight	2,400 lb.
High Speed at Sea Level.	136 m.p.h.
Cruising Speed at 3,000 ft.	118 m.p.h.
Landing Speed	45 m.p.h.
Rate of Climb	750 ft. per min.
Service Ceiling	14,420 ft.
Absolute Ceiling	17,900 ft.

Seaplane ATC'S

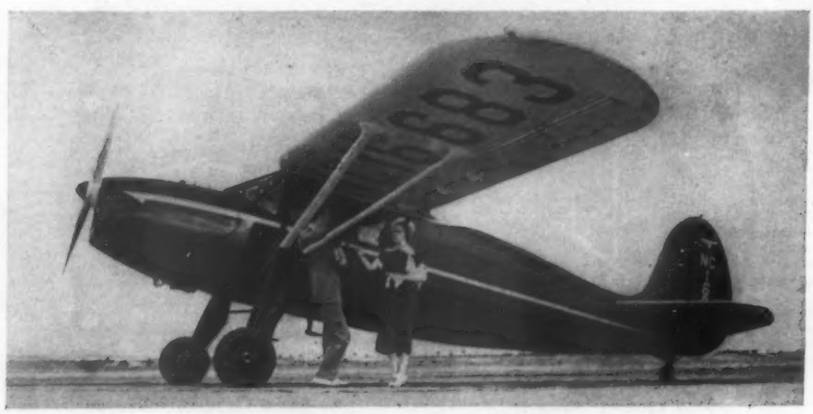
Stinson Reliant and Taylor Cub licensed on Edo floats

THE SR-7 and SR-8 series Stinson Reliants are now available on Model 4000 Edo floats with water rudders as standard equipment. These ships are fitted with either Lycoming or Wright engines. Full load, glassy water take-offs can be made in less than 30 seconds. Cruising speeds are better than 120 m.p.h. A number have been delivered recently to owners in the United States, Canada, and Norway.



For the first time the Taylor Cub has been licensed as a seaplane on Edo floats. Note arrangement of additional fin area.

For the first time license has been issued for a Taylor Cub as a seaplane. The 1936 Model J2 Cub has been



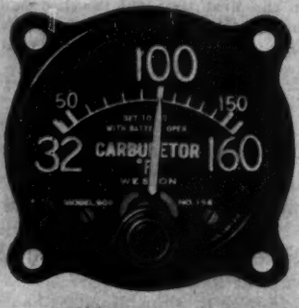
The New Fairchild Ranger "24".

WESTON Model 602
Air Temperature Indicator

WESTON Model 545
Tachometer Indicator

WESTON Model 606
Ammeters

WESTON Model 602
Cylinder Temperature Indicator



WESTON Model 606
Carburetor Air Temperature Indicator

WESTON *Electrical* INDICATION

PROVED BY MILLIONS OF SAFE TRANSPORT MILES

Millions of safe transport miles have cemented industry's faith in measurements provided by the electrical deflection of a pointer . . . a principle perfected by WESTON half a century ago...and first applied to aviation needs by WESTON in 1928. Today, the WESTON line includes instruments specifically designed to meet aircraft needs . . . instruments which add measurably to safety and aid in keeping operating costs low. Complete data on WESTON aircraft instruments are available in bulletin form . . . WESTON Electrical Instrument Corporation, 616 Frelinghuysen Avenue, Newark, New Jersey.

WESTON Model 635
Blind Landing Indicator

WESTON Model 602
Radio Compass Indicator

WESTON Model 606
Oil Temperature Indicator

Stinson Model SR-8EM on Edo floats ready for delivery to a Canadian customer.

granted an ATC on Edo Model 1070 floats. The licensed gross weight is 1,068 lbs. which, with an empty weight of 652 lbs., leaves 416 lbs. for useful load. This is divided up among pilot and passenger, full tanks of gas and oil, and 14 lbs. of baggage. After flight testing by Mr. Walter Jamouneau, chief engineer of the Taylor Aircraft Co., the first ship was delivered to the west coast for Mr. V. R. McNulty of Wilmington, Calif. Test results indicate that take-off from smooth water requires less than 30 seconds and that the speed in the air and the general handling characteristics are unchanged from those of the Cub as a land plane.

Porterfield Zephyr

New tandem monoplane to sell for $1295

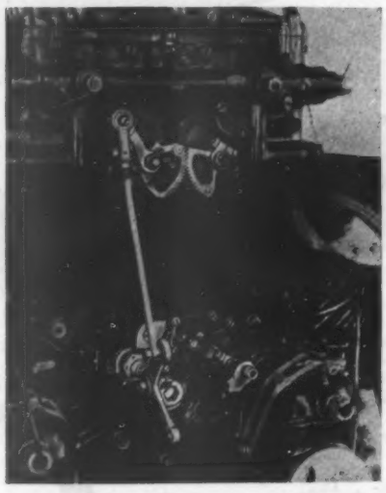
FOURTH ship in the Porterfield line is the new Zephyr low priced two-seater which recently has been test flown at Kansas City airport. The Zephyr has a Continental 40 hp. engine and sells for $1295. Fuel consumption is about 2 gal. per hour and sufficient tankage is provided for 4½ hr. of flying at a cruising speed of 75 m.p.h.

The Zephyr is a two place tandem monoplane of conventional construction with dual controls for training purposes. It was designed by H. W. Barlow of the University of Minnesota Engineering School.

"Boost" Regulator

Wright and Eclipse cooperate in new supercharger control

QUITE a while ago pilots and copilots ran out of hands and feet needed to operate all the gadgets necessary to the well being of transport planes, particularly at take-off. So Wright and Eclipse got together and developed an automatic, two-position supercharger "boost" regulator for Cyclone engines to supplant the old manually operated throttle stop system.



Regulator installed on Cyclone engine

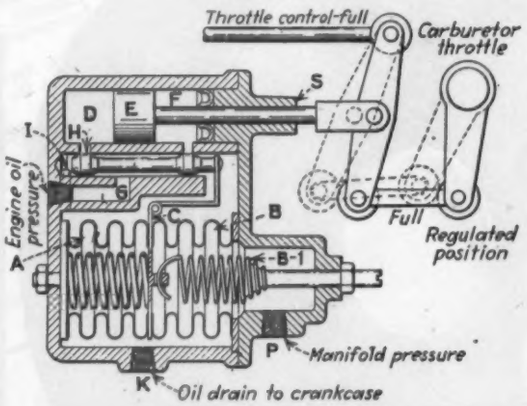
In the new device maximum boost is maintained at take off but, at cruising speed, it is limited to rated power by an engine oil actuated servo piston controlled through two sylphons by intake manifold pressure. The servo piston moves the throttle without any movement of the pilot's throttle control and the change-over is effected by the simple movement of a selector lever in the cockpit.

The regulator may be adjusted through a tension spring on one of the sylphons to maintain pressures between 24 and 40 in. of Mercury, absolute. Values for "Take-off" and "Cruising" positions for a particular engine should be obtained from the manufacturer. The regulator bolts to the rear cover of the Cyclone engine which has been modified to include flange openings for manifold air pressure, oil pressure, and oil drain, eliminating external plumbing. The crankcase vent for the oil tank has been removed from the cover and incorporated in the housing of the regulator. The engine manufacturer will furnish modified covers or drawings for changing covers of equipment now in service.

Westinghouse Transmitter

Lightweight voice equipment for private owner aircraft

AS A companion piece for the Type ER aircraft receiver, announced about a year ago, Westinghouse Electric & Mfg. Co. (Chicopee Falls, Mass.) has announced the Type GD transmitter unit. This outfit is rated at 15 watts when operating from a 12 volt battery, but will deliver 20 watts to the antenna with a fully charged battery and with the charging generator running. Its normal operating current is 11.5 amperes at 12 volts. It weighs, complete with remote control and reel trailing wire antenna, 27 lb. Two frequencies, both crystal controlled, are available, 3,105 kilocycles and 3,120 kilocycles. Change-over is accomplished by a frequency selector switch located at the remote control point.



At take-off the selector lever is set in "take off" position and the throttle opened full. If, as usually true, the manifold pressure at full throttle on the ground is above the regulator limit, the tension spring "B-1" is unable to offset the pressure communicated through "P" to sylphon "B" which then expands to the left carrying with it diaphragm "C". The diaphragm pushes oil valve "V" leftward, admitting engine oil under pressure from "G" through "H" into servo piston cylinder "D", forcing piston to the right and tending to close the throttle. When the throttle is closed sufficiently to provide proper manifold pressure, the drop is communicated to sylphon "B" which contracts to normal position and permits the oil valve to return to neutral as shown.

Any oil in chamber "F", displaced by the piston in moving toward the right, draws through "J" to return to the crankcase through drain "K". If the manifold pressure is below normal for the conditions the opposite action occurs.

When the throttle is closed beyond the point where the servo piston "E" reaches its inward stop "S", the regulator becomes ineffective and throttle control becomes normal.

One of the PIONEERS in AVIATION —AND STILL PIONEERING TODAY

24 years ago—page from Goodyear pamphlet published in 1912.

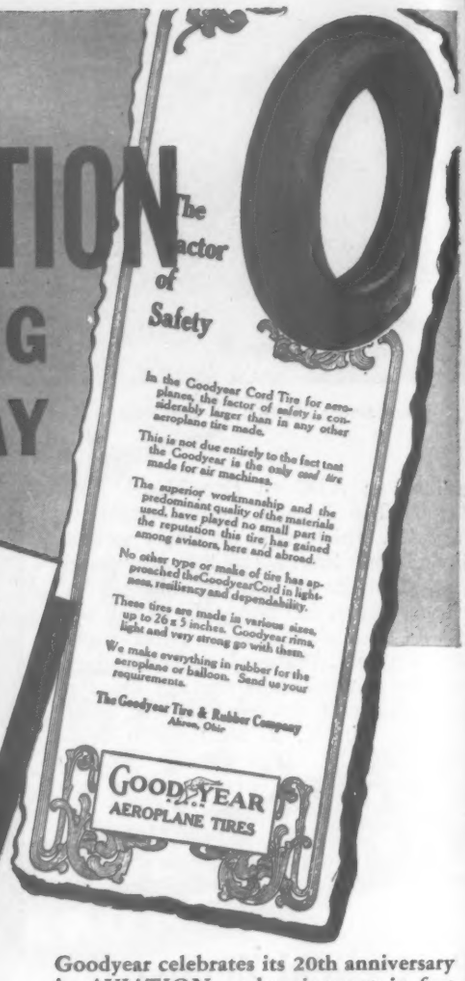
Curtiss Biplane, with Goodyear Equipment, Built for U. S. Navy

A Vital Point

Remember that the planes are the sinews of your aeroplane. Together with the engine and the frame, the strength of the fabric is of utmost importance. So the points discussed here have deep significance. They call for your attention.

The U. S. War Department Uses Goodyear Aeroplane Fabric

...e Curtiss Aeroplane Company, Burg... ...ght Company, Burg... ...International...


The Factor of Safety
In the Goodyear Cord Tire for aeroplanes, the factor of safety is considerably larger than in any other aeroplane tire made.
This is not due entirely to the fact that the Goodyear is the only cord tire made for air machines.
The superior workmanship and the predominant quality of the materials used, have played no small part in the reputation this tire has gained among aviators, here and abroad.
No other type or make of tire has approached the Goodyear Cord in lightness, resiliency and dependability.
These tires are made in various sizes, up to 26 x 5 inches. Goodyear rims, light and very strong go with them.
We make everything in rubber for the aeroplane or balloon. Send us your requirements.
The Goodyear Tire & Rubber Company
Akron, Ohio
GOODYEAR
AEROPLANE TIRES

Goodyear celebrates its 20th anniversary in AVIATION — advertisement in first issue, August, 1916.

IN joining with the aviation world in celebrating the 20th anniversary of commercial flying, Goodyear proudly recalls its own quarter-century of contributions to safer flight which have helped speed man's progress in the air.

As early as 1910 Goodyear was the leading manufacturer of airplane tires, rubber springs, Bleriot type shock absorbers and rubberized "aeroplane" fabric. In the 1911 Chicago Air Meet 90% of the entries used Goodyear products.

That pioneering still goes on at Goodyear as evidenced by the huge, super-soft Airwheel* and Goodyear's quick-stopping, sure-gripping, instant-releasing Airplane Brakes, both hydraulic and pneumatic — latter day developments that add immeasurably to the safety and comfort of today's big swift ships.

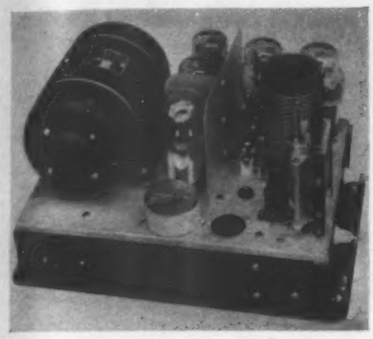
In designing and building the super-craft of the future Goodyear is ready to work with you wherever rubber can serve — just as it always has in the past. Write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, Calif.

*IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL!

AIRWHEEL is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires.

ON YOUR NEW SHIP SPECIFY GOODYEAR AIRWHEELS AND GOODYEAR AIRPLANE BRAKES

Two types of remote control are available. One consists of a standard aircraft instrument case which mounts switches and microphone jack on a suitable panel, in the other method the switches and the microphone jack may be located separately with individual nameplates at convenient places in the airplane. In either case the antenna current meter is mounted separately.



Westinghouse GD radio transmitter with cover removed showing how dynamotor is mounted as a part of the chassis

Suitable relays are provided so that the same antenna can be used for both transmitting and receiving. Test jacks are fitted for ease in adjustment and servicing.

A single plug makes connection from transmitter to the battery and the remote control unit. This is made possible by mounting the dynamo on the same chassis with the transmitter. Adequate fuse protection is provided in both the low and high voltage circuits. Snap slide fasteners are fitted so that the transmitter is readily removable from the mounting base for inspection.

Direction Finder

Cathode-ray beam course indicator developed for aircraft use

AFTER many years of supplying radio direction finding equipment to the merchant marine and the government, the Airplane & Marine Direction Finder Corporation (Lindenhurst, L. I., N. Y.) is offering for commercial aircraft use an aural-null and right and left visual indicating direction finder using a cathode-ray beam instead of the conventional needle in the indicator.

The equipment is the invention of Edward J. Hefele, the company's radio engineer. It has had 150 hours of flight testing, 40 of them at night, in the hands of C. T. Solt, chief radio electrician attached to the Communications Division, Coast Guard Headquarters. The Coast Guard Communications Bulletin has reported "particularly encouraging" results from the tests.

The set-up, which totals 68 lb. including power supply exclusive of batteries, consists of a power unit (12 volt plane battery), loop antenna, receiver and its remote control unit, and the visual indicator. The loop, as used on all direction-finder-equipped planes of the Coast Guard, is mounted inside a fixed streamlined housing atop the fuselage, and is turned with a hand wheel until the null point of the signal is heard, when a bearing may be taken directly in degrees from a reciprocal scale and pointer at its base.

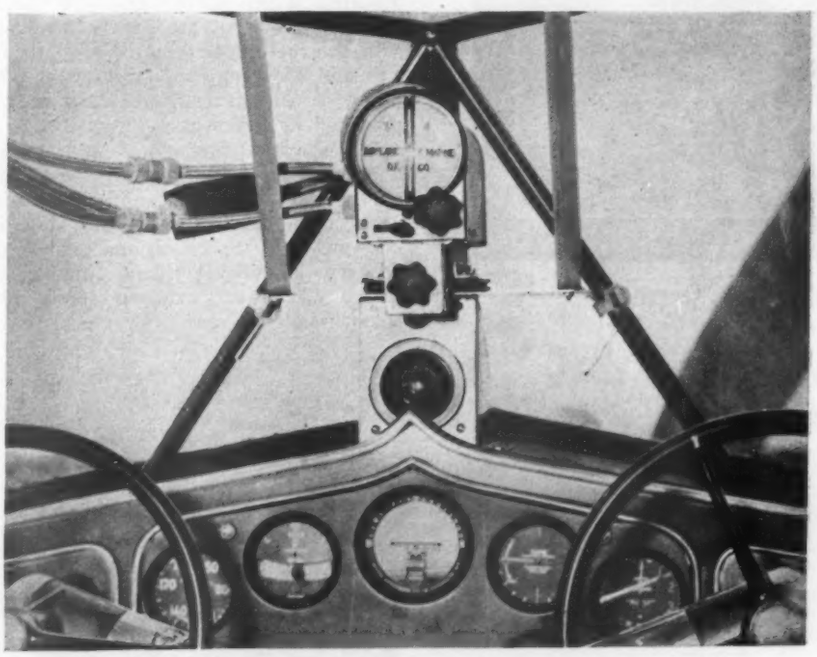
Frequency range of the receiver is from 194 to 1,545 kc. Provision is made for a plug-in jack for earphones, permitting simultaneous reception of voice signal, aurally, and course-bearing indication, visually.

Most interesting part of the set-up is the visual indicator itself. It consists of a small box containing a cathode-ray tube with a vertical index showing "on-course" position. When the receiver is turned on the tube produces a spot of light in the center of this screen, which, when a radio signal is received, stretches into a line. By rotating the loop till the line is in the "on-course" position, the bearing to the station is directly readable on the loop scale. By then setting the loop on zero, and swinging the plane toward the station on which the bearing was taken, the direction finder may be used as a homing device indicating right and left.

The angular position of this line is unaffected by electrical interference (dust static or electrical storms), the only effect being fuzziness on the line's edges. Sensitivity of the indication is readily controllable by the pilot.

"Over-station" indication is positive. When the edge of the cone of silence is reached, the line of light on the screen separates in the middle and forms an ellipse, gradually spreading to a circle as the center of the cone is reached. Indication of "sense" of direction is automatic, and is determined by the indicator line's swinging in the opposite direction to the swing of the plane. When this happens a selector switch mounted on the front of the indicator box is thrown to the "recede" position.

This close-up (above) shows the beam indicating that the ship is flying to the left of the proper course. Right rudder would make the line coincidental with the vertical index.



Above is the installation of the cathode-ray direction finder indicator unit as mounted in the vee of the windshield in the Coast Guard's Stinson experimental ship.

and the indicator again reacts normally. The bearing indicator line remains constant, and turns to right or left equally with the rotation of the plane.

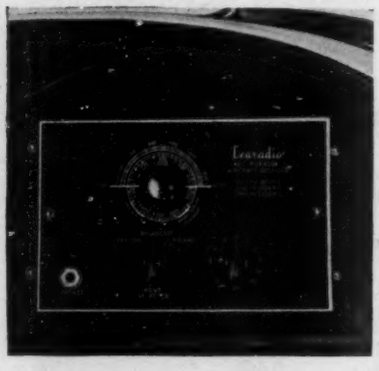
Telegraphic code and signals such as A and N beacon signals are readable on the indicator at speeds up to 25 words per minute, and cause no angular deflection of the line of bearing.

Two-Way Learadio

New units combine for lightweight 2-way communication

MENTION was made last month (AVIATION, July, 1936, p. 43) of the new type T-15 Lear-O-Phone transmitter (Lear Developments, Inc., 121 W. 17th St., New York, N. Y.) recently announced. Word has since come in of a new Lear receiver which, with the Lear-O-Phone, gives a complete two-way communication system for aircraft which weighs only 23 lb. complete.

The Type R-3 receiver is a compact unit (panel size, 5 in. x 7¼ in.; 4½ in. deep) covering three frequency bands (220 to 400 kc.; 550 to 1500 kc.; 2800 to 6300 kc.) under control of a simple selector switch. It is designed principally for direct operation, but remote control unit can be furnished when required. Circuit is of the superheterodyne type. The set will operate either from storage battery or from dry cells. It incorporates an automatic static limitor to reduce headphone noises to a minimum. The set itself weighs 7 lb. and the power unit another 7 lb.



Lear Type R-3 Receiver

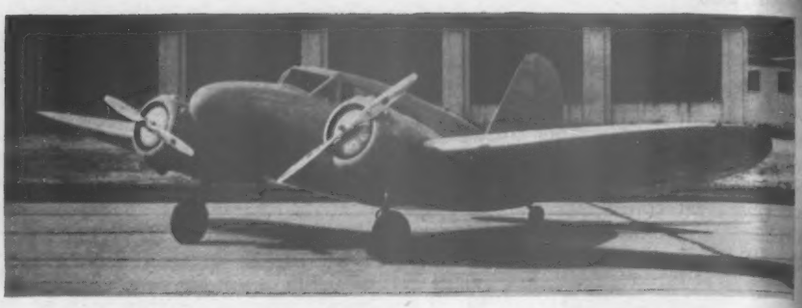
Twin Monocoach

Light bimotor introduced by Lambert Aircraft Corporation

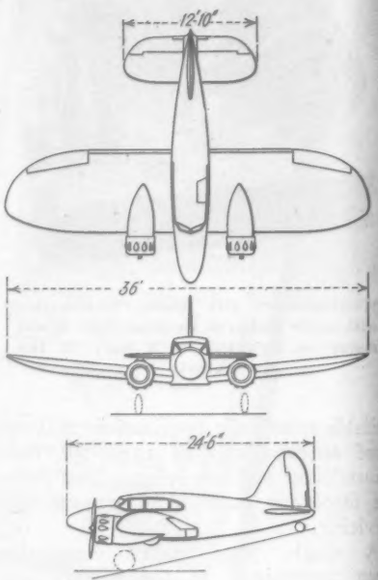
SINCE the transport lines set the style of twin-engined low-wing monoplane equipment, there has been much thought among designers of subdividing the power plant in smaller ships. Already it has been done in feeder line equipment having capacity for eight passengers. But Lambert went a step lower in the weight range and the result is a four-five-place plane with two 90 hp. Lambert engines known as the Twin Monocoach.

The first of these ships has been flown through Kansas, Oklahoma, Texas, Illinois, and Missouri in a demonstration tour by Clare W. Bunch, president and general manager of Lambert. During the first week 1,868 miles were covered in 12 hours, 35 minutes. Cruising normally at 130 m.p.h the ship has a range of about 900 miles using the full fuel capacity of 70 gal. of gasoline when operating as a four-place ship. When used as a five-place ship the fuel capacity is reduced to 40 gal. and the range to about about 500 miles. A 200 lb. baggage allowance is provided in either case.

Transport features such as retractable landing gear, and split type balanced wing flaps are found in the Twin Monocoach. Structurally the ship is conventional. Specifications are: span 36 ft., length 24 ft. 6 in., gross weight, 3,220 lb.; cruising speed, 130 m.p.h.; landing speed, 40 m.p.h.



The Lambert Twin Monocoach, Model H



Lockheed 12

Designer on transcontinental test flight

FLYING as a passenger in a transcontinental test flight is Hall F. Hibbard, Lockheed's chief engineer in his latest creation,—the Lockheed 12. The new ship, powered with two Pratt & Whitney Wasp Jr. S. B. engines (combined output, 450 hp.) is one of the answers to the Department of Commerce feeder line specification. It is a smaller edition (eight place) of the familiar Electra, having a span of 49 feet 6 in., and a length of 36 ft. 4 in. Top speed is nearly 230 m.p.h. (5,000 ft.); cruising speed, 208 m.p.h. (9,600 ft., 60 per cent power). Maximum fuel capacity is 195 gal. and cruising range, 880 miles. Gross weight is 7,925 lb., and useful load, 2,570 lb.

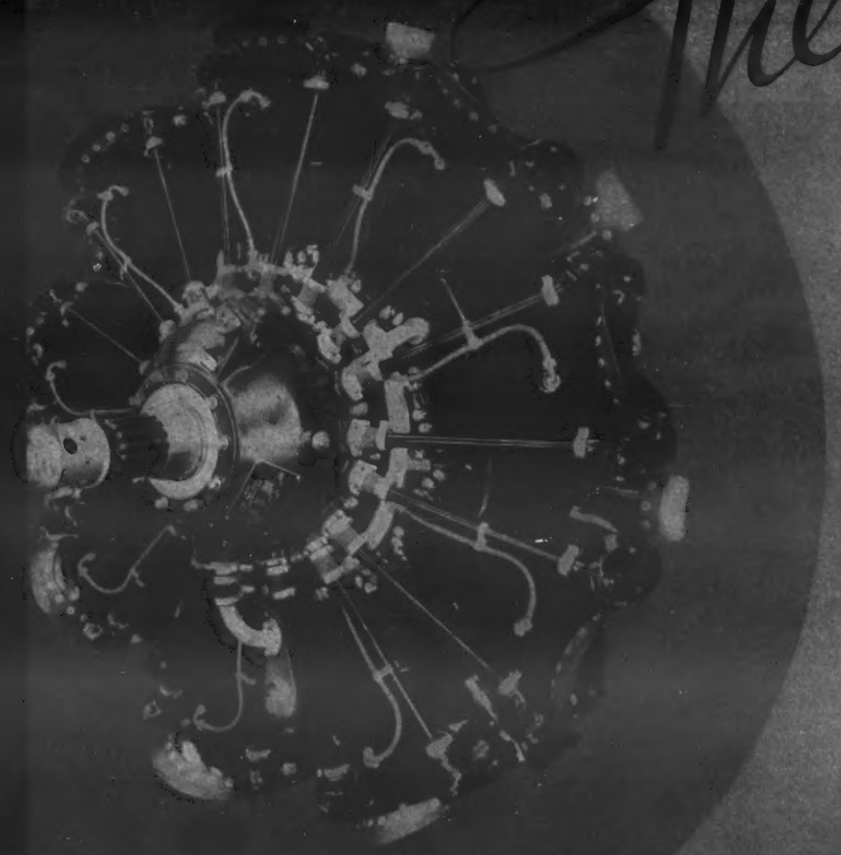
Before final assembly, the first Lockheed 12 was subjected to a particularly severe series of static tests. The fuselage was hoisted aloft by means of a derrick and flipped over on its back. It was then placed upside down in a special jig and the wings were attached for the static tests.

Fifteen tons of sand were loaded in bags on the wings and about five tons on the engine nacelles, to prove the accuracy of the calculations made.

First actual photo of Lockheed 12

The 1000 H.P. G CYCLONE

NOW AVAILABLE FOR EXPORT SALE



The new 1000 h.p. Wright Cyclone—the world's most powerful, single-row radial, air-cooled engine in service operation—is now available for export sale!

1000 h.p. for take-off; weight of 1.07 lbs. per horsepower; extremely low fuel consumption of .43 lbs. per brake h.p. hour in the cruising range; new cylinder heads giving 2800 square inches of fin cooling area per cylinder; the dynamic damper eliminating torsional vibration; automatic lubrication of the valve gear—are noteworthy features of the new "G" series of Wright Cyclone engines.

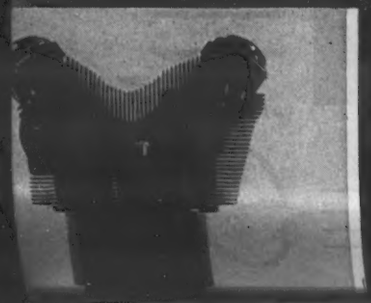
Five thousand Cyclones have been sold during the past 10 years—one thousand in the first 6 months of 1936. The new "G" Cyclones are already in daily service operation on major scheduled air routes in the United States—and earlier models are performing constant, dependable service in commercial and military operations throughout the world.

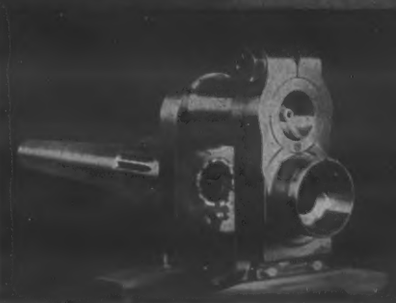
Intense research in the Wright laboratories has kept the Cyclone continuously in the forefront of world development—forecasting higher horsepower ratings in 1937.

Write for New Catalog Describing the "G" Cyclone

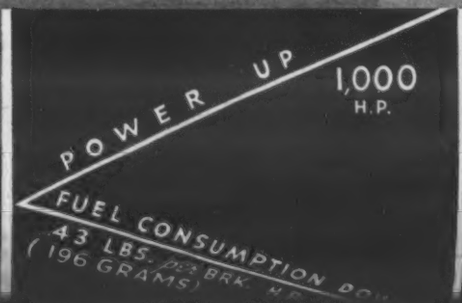
WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

New "G" Cylinder — Wright Dynamic Damper





WEIGHT
1.07 LBS.
per
HORSEPOWER



PRECISION BEARINGS

FOR AIRCRAFT CONTROLS

A pioneer experience of a quarter-century is reflected in the manufacture of the PRECISION Aircraft Control Bearings pictured above. During the World War, and in the years since, NORMA-HOFFMANN PRECISION Bearings have been an important factor in aircraft construction, in many vital applications. In practically every history-making flight, NORMA-HOFFMANN Bearings have participated—in planes, engines, controls, instruments or accessories.

The first high-grade ball bearing control pulleys were equipped with these NORMA-HOFFMANN PRECISION Bearings. And NORMA-HOFFMANN engineers, still pioneering, have developed many of the distinctive bearing types now accepted in aviation practice. Today almost every representative manufacturer of aircraft and equipment—including the U. S. Government—is a user of NORMA-HOFFMANN PRECISION Bearings.

The NORMA-HOFFMANN line of 108 distinct series includes—besides control bearings—PRECISION Ball, Roller and Thrust Bearings for practically every aviation requirement. Write for the Catalog, and the booklet "Precision Bearings for Aircraft Controls." Let our engineers work with you.

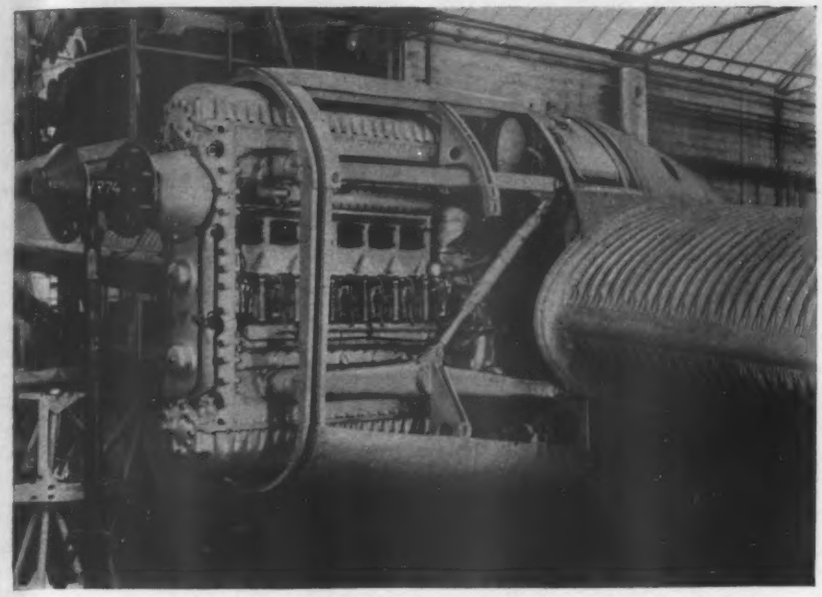
"NORMA-HOFFMANN"

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

PRECISION BALL, ROLLER, AND THRUST BEARINGS

With Foreign Builders

Diesel engines gain favor on air transport lines in Europe



A typical installation of the Jumo 5C diesel engine.

WITHIN the last year and a half there has been a great revival of interest in diesel power plants on European airlines. This interest is not restricted to Europe alone but has extended to the United States. According to the Association of German Aircraft Industries, negotiations are reported now under way and a plane is said to be under construction in the United States, to be powered with six Junkers diesels to fly on a trans-Atlantic schedule between Europe and North America. In Germany the Junkers Aircraft Corporation is now testing a 2,000 hp. engine.

The French Government has offered a prize of 10,000,000 francs for the development of a diesel engine suitable for long distance flying across the Pacific and the Atlantic. The Air Ministry has reserved the right to enter two engines of their own design in competition. It is understood that the winner will receive an order for 500 engines.

Lufthansa, Germany's great airline, is now undertaking the replacement of all its gasoline engines with diesel engines. All planes to be added in the future will be diesel powered. Typical of their latest equipment is the Junkers Ju-86 transport described on page 27 of AVIATION for April, 1936. This airplane was originally built with two BMW Hornets of 644 hp. each. The latest models, however, have been turned out with two Junkers Jumo 5C engines of 600 hp. each. This latest type of machine has a span of 74 ft., length overall 54 ft. and a wing area of 883 sq.ft. The following table shows the comparative characteristics of the Junkers Ju-86 with the two power plants.

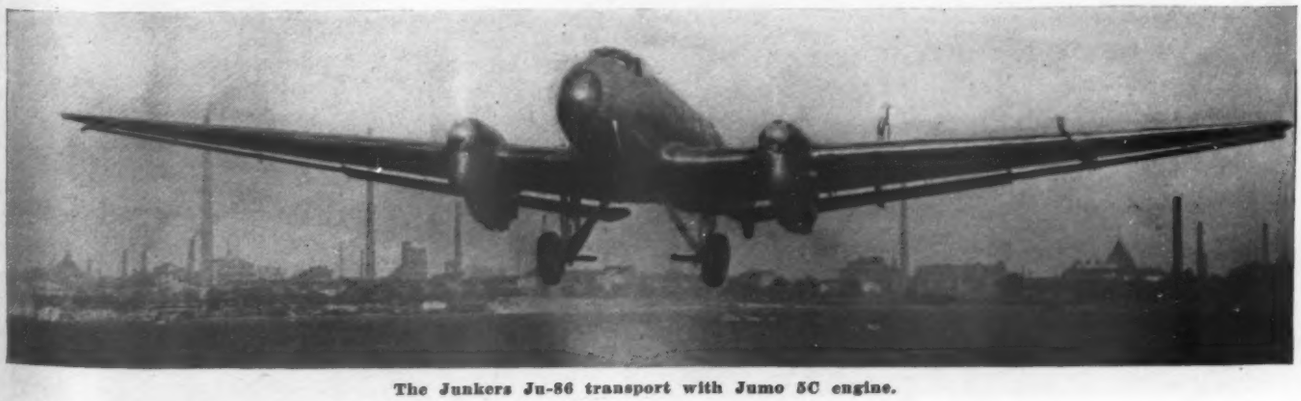
	With BMW Hornets	With Junkers Jumo 5
Total horsepower	1,288	1,200
Weight empty, lb.	10,184	11,050
Disposable Load, lb....	5,677	5,130
Gross weight, lb.....	15,100	16,180
Maximum speed sea level, m.p.h.		
Range at cruising speed (183 m.p.h.)	435	512
Service ceiling, ft.....	18,500	21,300
Service ceiling (with one engine dead at gross weight)	4,388 ft.	8,850 ft.
Climb (to 3,120 ft.), min.	4.2	3.6
Climb (to 9,260 ft.), min.	16.5	13.0

Another German transport using the Jumo 5 engine is the Dornier Do-18, a long-range mail and cargo flying boat now in service across the south Atlantic. This ship has an all-metal hull with smooth outer skin and flush riveting. It is designed especially for catapult launching. Wing structure is also of metal with fabric covering. The characteristic trailing edge airfoils are hinged slightly below the trailing edge of the wings and act both as ailerons and as landing flaps. The ship normally carries a crew of four. Its span is 78 ft., length 63.3 ft., total wing area is 1,055 sq.ft. Power plant consists of two Jumo J-5 engines, one as a tractor, the other as a pusher, developing 1,100 hp. total at sea level. Its weight empty is 11,400 lb., total disposable load 9,000 lb., gross weight 20,400 lb. The ship has a maximum speed at sea level of 146 m.p.h. The range at a cruising speed of 132 m.p.h. is 2,500 miles. Its service ceiling is 10,500 ft.

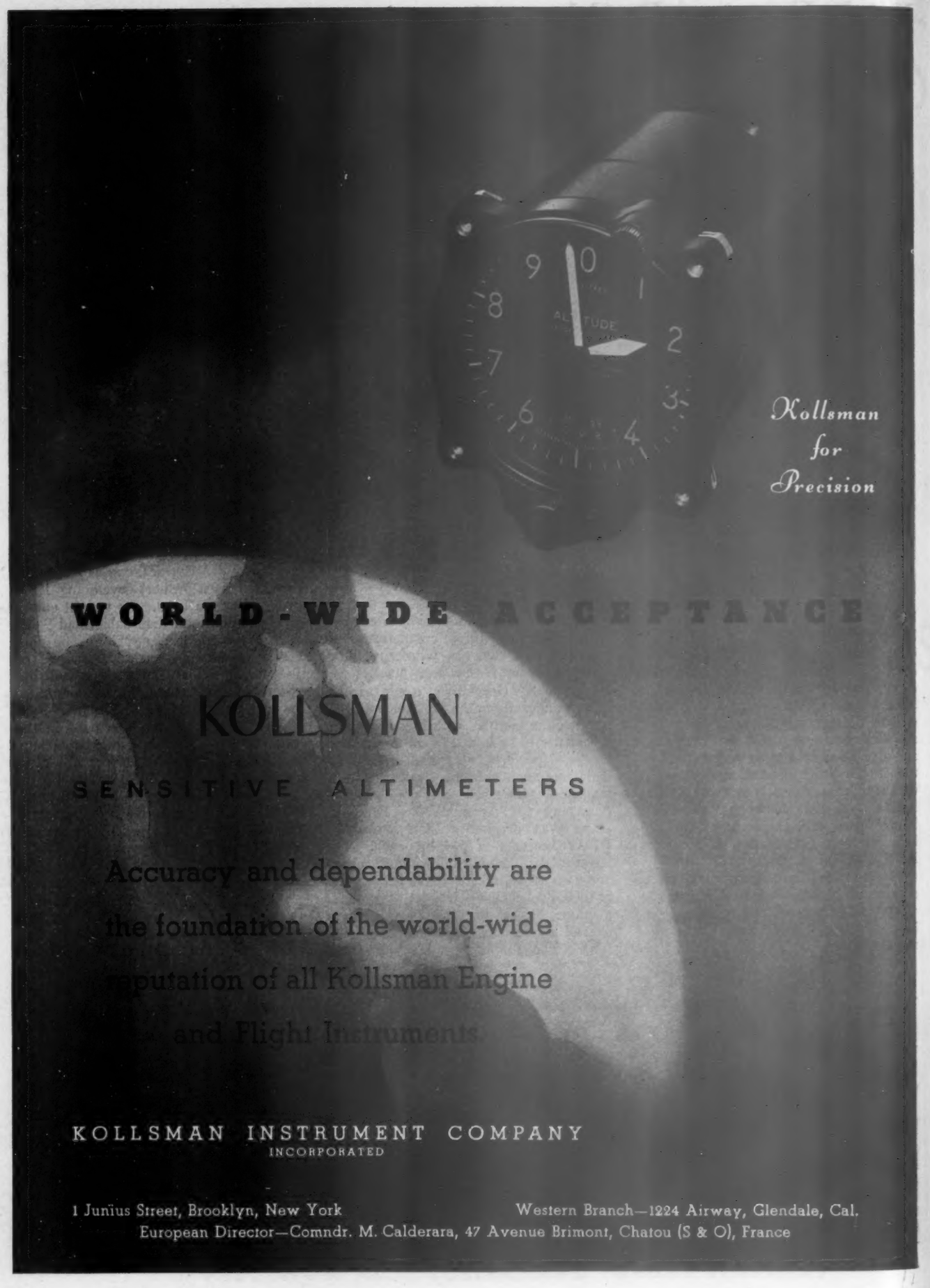
The latest type of Jumo used in the Ju-86 and Do-18 is the 5C rated at 600 hp. at 2,200 r.p.m. or 1.76 lb. per hp. With reduction gear it develops 700 hp. at 2,300 r.p.m. at 15,000 ft. Napier has secured the English rights to manufacture Junkers diesels, likewise Lille of France, and Mitsubishi of Japan.

All new installations will be placed horizontally in the wings and be completely covered. Cooling liquid used is Prestone or its equivalent.

Junkers is now experimenting on a geared engine of 2,000 hp. at 3,400 r.p.m.



The Junkers Ju-86 transport with Jumo 5C engine.


Kollsman
for
Precision
WORLD-WIDE ACCEPTANCE
KOLLSMAN
SENSITIVE ALTIMETERS
Accuracy and dependability are
the foundation of the world-wide
reputation of all Kollsman Engine
and Flight Instruments
KOLLSMAN INSTRUMENT COMPANY
INCORPORATED
1 Junius Street, Brooklyn, New York
Western Branch—1224 Airway, Glendale, Cal.
European Director—Comndr. M. Calderara, 47 Avenue Brimont, Chatou (S & O), France

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Multiple Circuit Connectors

Breeze develops new line of connectors for aircraft use

WITH quick demountable engine installations a part of every modern airplane, means for quickly disconnecting a number of electrical circuits are highly desirable. Breeze Multiple Circuit Connectors in several sizes have been especially designed for aircraft and aircraft instrument installation. Built to Air Corps specifications, they consist of a plug and a socket assembly. They are available in sizes with three contacts (two 200 amp. and one 25 amp.) to 14 contacts (12–10 amp. and 2–25 amp.). At present there are seven intermediate sizes between these two extremes. Dimensions are small (the largest assembly is only 3½ in. long, 1⅞ in. in diameter). Contact pins are arranged so that plugs can fit sockets

Breeze multiple circuit connector.

in one position only. All connectors are shielded for use in conjunction with radio apparatus and are designed to fit standard Breeze shielding conduit and fittings.

New Aircraft Battery

Prest-O-Lite Unit of high capacity especially designed for transport service

FEW aircraft components have "taken it on the chin" as has the storage battery in the last few years. Every new auxiliary put on board has added just so much to the battery load, and operators have long since been looking for units of high discharge capacity but with outside dimensions to fit standard battery boxes. To meet this situation, the Prest-O-Lite Battery Company, Inc., of Indianapolis, Ind., has just placed on the market a new battery whose outside dimensions are within the limits set by older types but which has

Prest-O-Lite Type R-1213 G transport battery.

an electrical rating of 105 amp.hr. at the 5 hr. rate and 150 amp. at the 20-min. rate (S.A.E.). The net weight of the battery with electrolyte is 91 lbs. The overall dimensions are: length 14⅞ in., width, 7¼ in.; height 10⅞ in. Each cell contains 13 plates 7x6 in.

Structural features of the new battery are novel. Instead of bringing the cell connectors out to the top of the battery, as is usual practice, the connectors pass through the compartment walls under the battery cover and directly above the plates. Located below the liquid level, the heat at high discharge rate is dissipated through the electrolyte. The cover construction is ingenious. Molded into it, is a pair of manifolds through which the gases emanating from the cells are passed to a common discharge outlet. In each manifold is a glass tube filled with a granular acid neutralizing material which removes the acid from the gases leaving the battery. Acid neutralizing tubes are readily removable, are inexpensive to replace. They need be replaced at relatively long intervals only. A special non-spill vent arrangement is built into each filler cap in each cell. A cleverly designed lead weight with a rubber valve attached closes the vent hole and prevents loss of liquids in case the battery is inverted or tipped over onto its side.

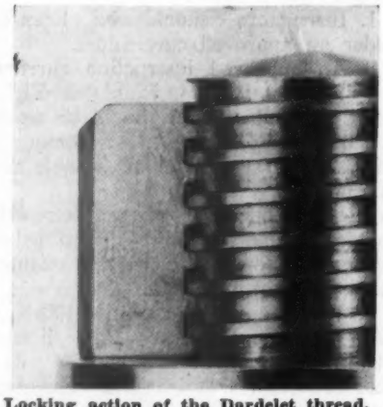
The assembly is clean cut in outward appearance, and it is easy to keep clean due to the leakproof construction. The only exposed lead parts are the two terminals.

Threadlock

Dardelet device approved by Department for aircraft use

THE DARDELET self-locking screw thread (Dardelet Threadlock Corp., 120 Broadway, New York) has recently been granted Department of Commerce approval for use on licensed aircraft. This special screw thread was designed to provide screw fastenings which would remain tight under all service conditions without lock washers, jam nuts, cotter pins or other auxiliary locking devices. It can be furnished in all workable materials by all commercial processes. It can be heat treated without loss of locking efficiency, and is available for special conditions in alloy steels and non-corrosive metals with all commonly used platings and rustproof finishes.

The locking action is illustrated in the accompanying photograph. The locking surfaces are the tapered faces of the root of the bolt thread and the crest of the nut thread. Until the nut is seated, the taper thread faces are not in contact in the unlocked position, and the nut is free running. When seating occurs, the nut is forced upward and locking is caused by static friction between the contact surfaces of the bolt and nut. When the nut is turned home,



Locking action of the Dardelet thread. After seating, additional turning of the nut locks it in place by forcing the tapered surfaces of the bolt and the nut together as shown.

the surface thread faces of the bolt are elastically compressed and those of the nut elastically expanded. Unlocking is accomplished by simply backing off the nut with a wrench. Dardelet threaded devices are available in a wide range of sizes and types for aeronautical and other applications.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 14: What do you think of the present regulations for medical examinations for flight students? Do they discourage students from getting started because of the expenditure of time or money involved? Would there be any great risk in amending them to defer the examination until the student had several hours of dual? Should the number of medical examiners be increased or should the examination privilege be extended to other physicians? Should the Air Commerce Bureau permit operators to charge for the flight demonstration time up to one hour that is now allowed only if given free?

Recommendations for "volume"

WE LIKE the contributions of Mr. Mason and Mr. Pierce in your May Operators' Corner. We also feel that present medical regulations retard student activity and private plane purchases and useage, at our port, to some extent. However, we are strong for regulations that insure proper safety measures even though we favor some changes and we do think ten dollars is much too high.

Everywhere the popular cry by manufacturers, operators, Department of Commerce, N.A.A. is for volume. Naturally it is a popular subject here too, and aside from the medical examination recommendations we have three or four in mind that we think may help some in the direction of volume, as follows:

1. Instructors should be licensed under an approved curriculum.

2. An approved instruction curriculum (as the Brooks, Randolph Field, or other good course) should be established by the Department of Commerce and its use required of all schools and instructors.

3. Fifty-hour LCs (properly trained) should be allowed more liberal privileges, based on rigid tests and examinations, but not instruction.

4. We recommend a special 100-hour LC. Applicants for this license (trained as suggested above), who pass tests and examinations, equivalent to transport, be allowed transport privileges (including instructing, if he passes instructors examination also). However, his cross-country charter should be limited to daylight only and up to radius of 250-miles from fixed base, until his hours and experience warrant added privileges. Fitness of applicant for this license (in all ways, particularly for instructing) should be left to judgment of examining inspector.

5. Student medical examination should be considerably reduced in price and not required until student is ready for first solo flight; provided recommendations as above regarding licensing instructors and setting-up an approved curriculum are established.

6. Hours for private-license might be reduced after character of instruction training and licensed instructors are established, which may prove an added inducement toward volume.

We offer a brief explanation of our recommendations as follows:

1. All transport pilots may be excellent fliers but all are not necessarily excellent instructors.

2. An approved curriculum will eliminate much inefficient instruction; will produce much safer and more capable pilots in less time and yet pilots who will pass their tests the first time they are examined.

3. Fifty-hour LC pilots (trained as recommended) could safely carry pay passengers on short cross-countrys (approximately 50 miles from fixed base) and other local activity but should not instruct.

4. Under proper training and supervision a 100-hour LC could capably perform transport functions (with exceptions as indicated in our recommendation No. 4) and his temperament and fitness for instructing could be decided by the Bureau inspector. During the World War there were many very capable instructors with less than 100 hours. Now with up-to-date ships, motors, and other facilities we can surely develop as good or better instructors, all necessary qualifications considered.

5. With approved curriculum, licensed instructors will be capable of efficiently analyzing each of his students. However, we recommend that reasonable responsibilty for correct analysis and advice to the Bureau of Air Commerce and medical examiner be imposed upon instructors.

Recommendations Nos. 3 and 4 would open a large field of possibilities to hundreds of young men over the U.S., 50 per cent of whom have not a chance under present provisions. The present LC is of no value and few holders of them can finance themselves to transport. Neither can they sell Dad on the idea. If they could go to Dad with something to sell, resembling the special 100-hr. LC, I'll wager you'd see activity on the up-and-up all over the country in short order. I would predict also that in a reasonable time you would see a great many fine young fellows establish themselves, with light trainers and so on, on dozens of ports in each state, that otherwise lie dead as Hector except for an occasional transient who happens in. —E. C. NILSON, *Director, Aviation Department, Orlando, Fla.*

Question 17

(Answers to be published in September)

WHAT is your opinion of the D. of C. approved school regulations? Do you consider it worth while for an operator to go to the effort and expense involved in operating an approved school? If your school is approved, does your experience indicate that it has helped your business? In what ways has it been specifically helpful? Have you any suggestions for modification of regulations? If your school is not approved, what reasons have led you to avoid the approved status? Would any change in the regulations make approval worth while to you?

★

QUESTION 16: What is your method of estimating fares for taxi service? Do you base the charge on a straight mileage basis or on other factors? Do you charge an extra premium for night flying or flying under unusual conditions? Have you found your charges agreeable to customers?

Basic charge 18 cents a mile

MOST of our rates for charter trips are based on 18 cents per air-mile for a 4-place cabin plane, which means 6 cents per air-mile per passenger, where you have three passengers. The rate of course takes into consideration the distance from point of departure to destination and return, and if they are not returning with us, they of course have to pay the same rate as we have to bring the ship back. In fact, all of our rates are figured this way on a mileage basis, although we have some special rates that have been necessitated by competition of unscrupulous operators. We generally charge at least 20 per cent higher rates for night flying, but when it comes to flying under what you term unusual conditions we prefer to leave our plane in the hangar. In other words, we do not take any unnecessary chances. We have never had anyone make any complaint on the charges that we have made for their trip.—E. W. WIGGINS, *President, E. W. Wiggins Airways, Inc., Providence, R. I.*

AVIATION, April 1, 1916

OFFICIAL GOVERNMENT RECORDS OF

Martin Tractors and Seaplanes

GIVE THEM THEIR ENVIABLE POSITION

IN THE

AVIATION WORLD

Reconnaissance Aeroplanes

Aero Yachts

Military Seapla

Glenn L. Martin

LOS ANGELES, CALIFOR

THIS advertisement appeared in the first issue of AVIATION published April 1, 1916

THIS editorial comment appeared in the second issue of AVIATION, published April 15, 1916

Glenn L. Martin is one of the pioneers of aviation in America. He began in 1909 experimenting with aeroplanes and taught himself to fly, as have so many of the famous flyers of earlier history. In 1910 he was a constructor and through sheer merit, handicapped by lack of proper financial resources, forced his reputation to the top notch. He has a record of having manufactured a comparatively large number of aeroplanes of various types for the United States Government without a single serious accident to pilot or passenger in any of these machines, although continually in use by officers of the Signal Corps.

Orders now on hand by the Martin company are for the United States, Holland and Netherlands East Indian governments. Three types are being produced: a light two-man reconnaissance tractor, adopted for training work in the Signal Corps; a fast two-place tractor, carrying a useful load of 960 pounds, with a speed range of 46 to 86 miles an hour, fuel capacity for six hours and a climbing ability of 3,400 feet in ten minutes; and a two-place tractor seaplane, used in the Philippines and the Coast Patrol.

As a consistent advertiser in AVIATION since its first issue 20 years ago, it is a pleasure to express to the McGraw-Hill Company our thanks for the information and inspiration which, for two decades, their publication has imparted to all branches of the aeronautical industry. To this magazine belongs no small share of the credit for the steady progress of aviation and for its position of high importance in the world of today.

THE GLENN L. MARTIN COMPANY, BALTIMORE, MARYLAND, U. S. A.

Builders of Dependable *Aircraft Since 1909*

ANOTHER PROOF OF Continental LEADERSHIP

An Order for the Largest Number of Commercial Aircraft Engines Ever Placed in the United States!

ONE THOUSAND and FIFTY

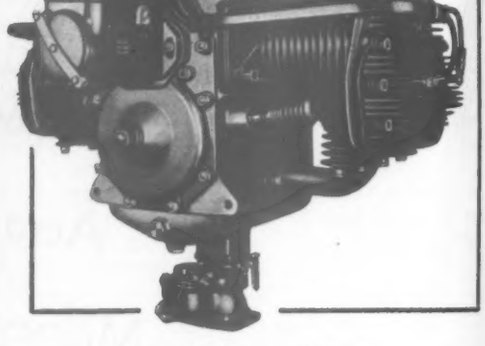
Model A-40
4-Cylinder Opposed Type Aircraft Engines

One thousand and fifty engines have been ordered from Continental by Taylor Aircraft Company of Bradford, Pa. These engines are for use in the Taylor Cub, a very popular 2-seated sport plane. This is indicative of the standing Continental enjoys in the field of aviation.

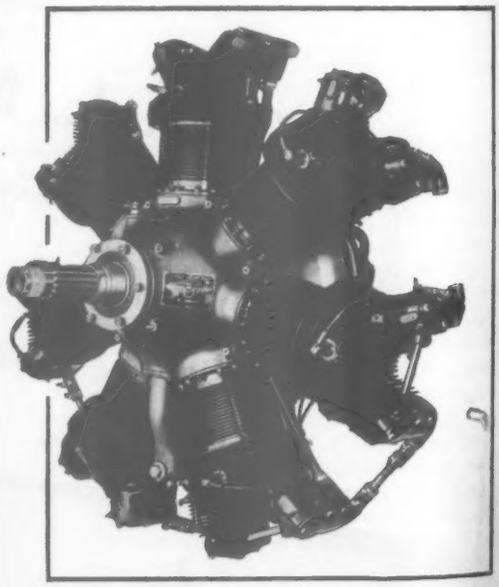
A-40 This popular, small-plane engine by Continental has established a unique record. More have been sold than any other engine manufactured for commercial or private use in America. Four cylinders opposed—now licensed at 40 H. P.—this latest series A-40 CONTINENTAL Aircraft Engine features numerous improvements and refinements.

W-670 This Engine is one of Continental Motors' new, outstanding achievements. Since its introduction this year, the CONTINENTAL W-670 has attracted widespread and very marked attention in the sport plane field. Among the progressive Continental improvements featured in this model are Automatic Forced Feed Valve Gear Lubrication; Lead Bronze Master Bearing; Removable Rocker Arm Bearings; Forged Pistons; Sodium Cooled Exhaust Valves. Available for battery or magneto ignition—provision for all types of controllable pitch propellers. Engine develops 225 to 250 H. P.

A-40 Front View



A-40 Rear View



W-670 Rear Exhaust

Continental Motors Corporation
Aircraft Engine Division
12801 East Jefferson Avenue • DETROIT, MICHIGAN

CONTINENTAL MOTORS — Power of the Air Nation — AMERICA'S STANDARD

News of the Month

Highlighting recent events in the aviation world.

★ ***World Transport*** . . . **New York-Bermuda service by Imperial, PAA, this fall . . . Pan American-Grace speeds service to Buenos Aires . . . Twice a week instead of once for PAA to Rio.**

★ ***Domestic Transport*** . . . **Non-stop N. Y.-Chicago service on American with DSTs . . . Boston-Maine finishes 1,000,000 miles . . . Eastern's complaint to I.C.C. postponed . . . Electras for Hanford . . . More mail pay for Inter-Island . . . Five more Twin Wasp-powered DC-3s for United, making fifteen.**

★ ***Bureau*** . . . **In three important moves, takes over traffic control on the airways. Earl F. Ward to head up new work.**

★ ***Army & Navy*** . . . **Army procurement program goes forward, with orders to Curtiss, Lockheed, Stearman . . . Air base to be selected for Alaska . . . Navy orders 50 Consolidated boats.**

★ ***Races & Records*** . . . **24th National Balloon race won by Goodyear entry . . . Distance, speed records for Douglas amphibian . . . Italians claim eight world seaplane records . . . New women's altitude record.**

★ ***Industrial*** . . . **Aeroneer completed . . . Taylorcraft sets up shop . . . Stearmans to Argentine . . . Wright sells 1,000,000 hp. . . . Taylor produces 70 in July, orders 1,050 Continental motors . . . Arrow to start production.**

★ ***Financial*** . . . **Capital expansion at Bell, Consolidated, Douglas, Lockheed, and Seversky . . . Profits for Bendix, Boeing . . . Ex-Cell-O declares a dividend.**

Bureau to Regulate Traffic

Takes over Traffic Control Stations, designates airways, promulgates new rules. Earl Ward at head.

THREE important moves were made last month by the Commerce Department and the Bureau of Air Commerce for the regulation of air traffic along the airways and for the elimination of dangerous congestion at terminal points.

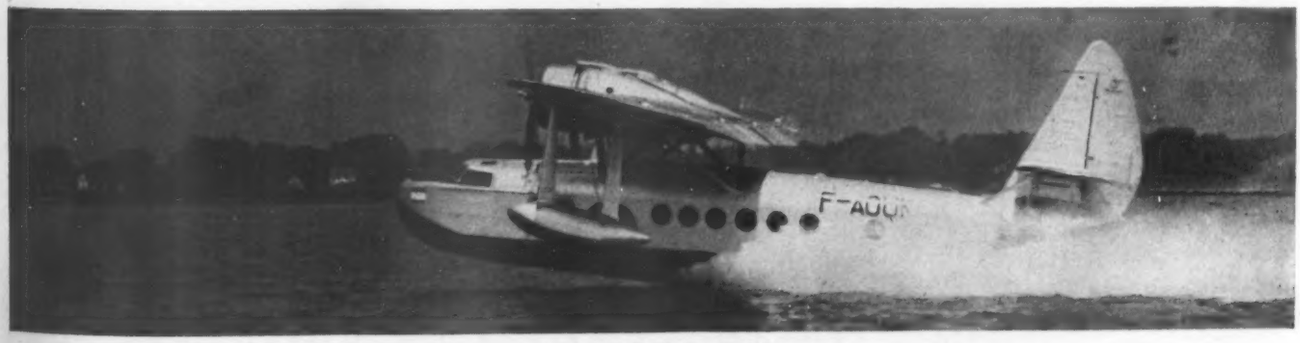
Move No. 1, effective July 6, established an airways traffic control system, taking over the three Airways Traffic Control Offices already established by the airlines at Newark, Chicago and Cleveland. Additional stations will be established soon at Detroit, Washington, Pittsburgh, Los Angeles and San Francisco. The function of these stations, as described in AVIATION for July, is to regulate traffic in and out of the airports in cooperation with the fields' traffic control towers.

Move No. 2 was announced July 14, and will become effective Aug. 15. It sets aside, as listed in an order of the Secretary of Commerce, 73 air routes, now flown by scheduled operators, as Civil Airways. Most of them are lighted and have emergency fields and radio facilities. An airway is defined in the order as being "contained within lines encircling each airport . . . at the ends thereof, with a radius of 25 miles from the center of said airport and also contained within two lines each parallel to and located 25 miles from the center line." It includes terminal and intermediate fields and "all other air navigation facilities" on the route.

The airways are generally wide enough to include both the beacon lights and the radio ranges (not always coincidental) along the route, and also the alternate routes the airlines are permitted to fly under certain weather conditions, though in some cases supplementary designations are necessary, as on Civil Airway No. 19 (Chicago-Twin Cities), and Civil Airway No. 19-1 (Chicago-Twin Cities via Rochester, Minn.).

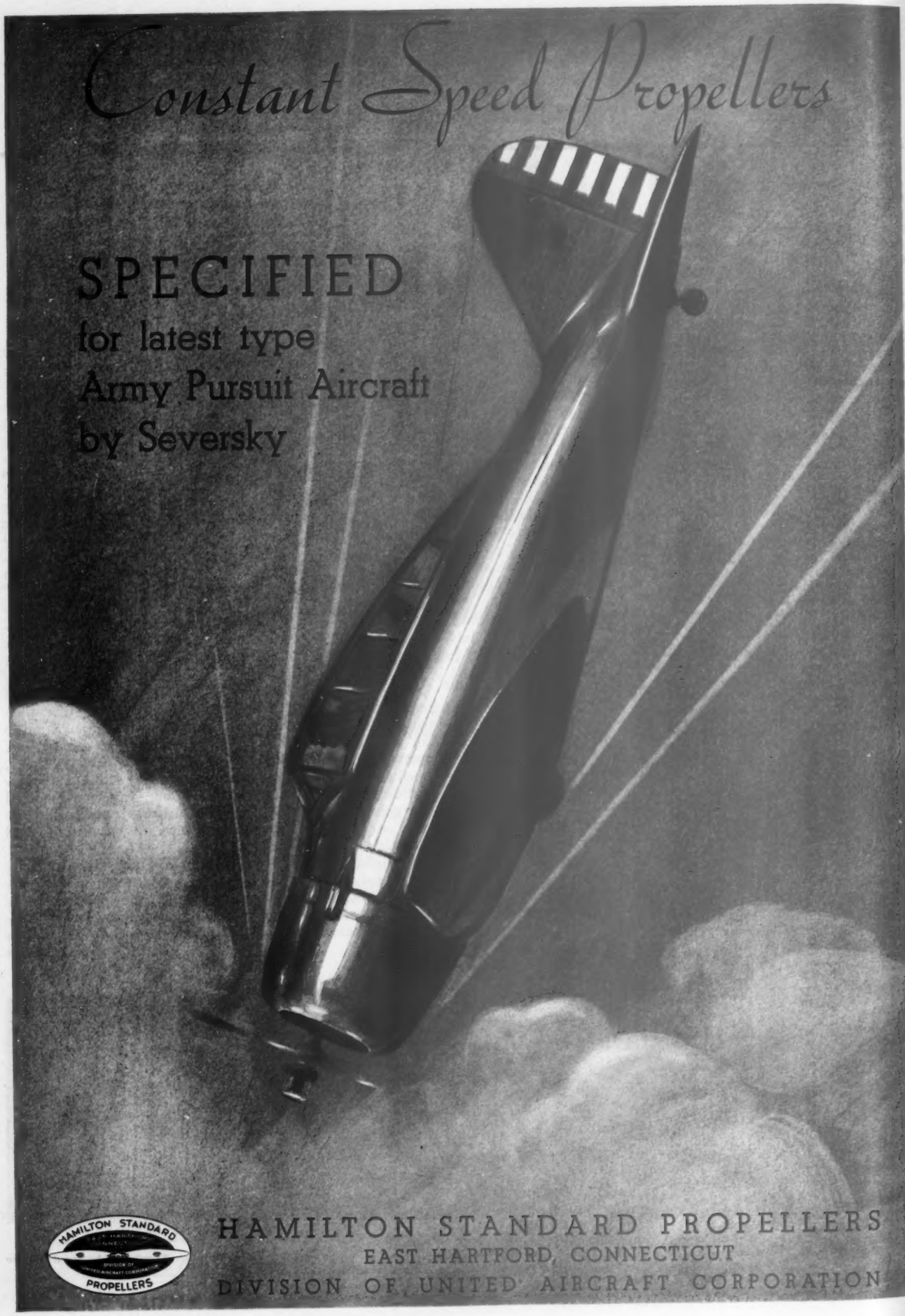
Thus the first two moves in a comprehensive Bureau scheme for regulation that has been under study for more than a year and a half. Last November the Bureau issued a ruling prohibiting intentional instrument flights in bad weather for other than scheduled operations within 25 miles of an airway or airline airport. A howl went up from private flyers, fixed-base operators, radio manufacturers. The ruling was soon modified to admit demonstrated ability as the determining factor in permitting blind flying.

Last month, in Move No. 3 of the July sequence, this early order was affirmed, and some rules, as an amendment to the Air Commerce regulations, laid down for the use of the Civil Airways in bad weather. Planes



SIKORSKY S43

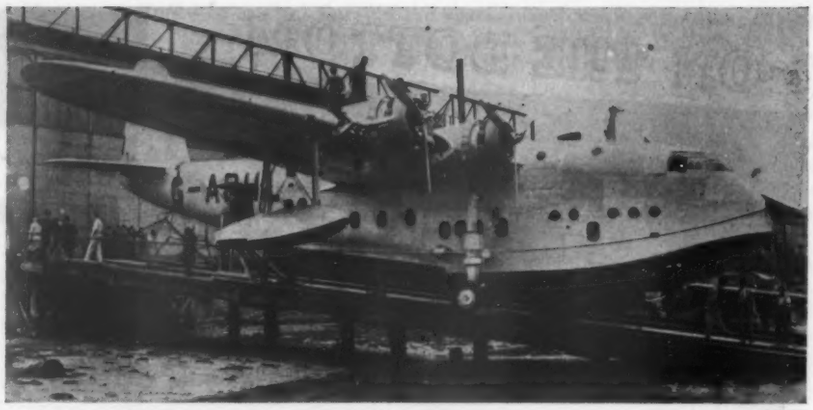
for Afican service. Three of these fast amphibians have been delivered to the French company Chargeurs Reunis. They will be used on the West Coast of Africa, between Dakar and Pointe Noire.


Constant Speed Propellers
SPECIFIED
for latest type
Army Pursuit Aircraft
by Seversky
HAMILTON STANDARD
PROPELLERS
HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT CORPORATION

not equipped for instrument flying are ruled off the airways under conditions of poor visibility, unless they fly between the bottom layer of the overcast and the ground. The new regulations apply only to the designated Civil Airways, and do not restrict flights which do not use them.

Pilots intending to make an instrument flight on an airway are required to submit a flight plan in advance. All aircraft must operate at prescribed altitudes: eastbound (from 0° up to but not including 180°), at odd thousands of feet; westbound (from 180° up to but not including 360°), at even thousands of feet. If an airway is crossed, it must be at 500 ft. above the prescribed altitude.

Directly in charge of air traffic control work is Earl F. Ward, who was appointed to the job last March. The system is the outgrowth of his experimental work for the airlines at Newark, where he was stationed before the Bureau recruited him.



ACME

BRITISH EMPIRE ROUTES

will be served by 28 of these Short Flying Boats, the first of which has just had its first flights. Power is from four Bristol Pegasus 740 h.p. radials.

"Express Only"

Rising loads may give older equipment new lease on life

GENERAL AIR EXPRESS, TWA's independent system, chalked up a record of 193,417 lbs., for the first six months of this year. This compares with 111,225 lbs. for the same period last year—a gain of 56 per cent. Add to this the significance of May's record 74.09 per cent load factor (9,724,333 seat miles flown, 7,205,083 seat miles occupied), and the line's space problem becomes acute. But TWA's Douglases have grown no larger.

To meet demands for space, and to afford a recurrent opportunity to get full use out of equipment made obsolete simply by the introduction of new types, TWA has been experimenting for several weeks with some of its older ships, retired from service when the Douglases came in, for "all express" service. Most favorably considered are its four tri-motored Fords, which, stripped of all passenger frills and limited in fuel supply to fairly short hauls, could pack payloads over 3,500 lbs. The average express shipment weighs about 9 lbs. This would mean, assuming a 50 per cent average load, income of about $1,680, or $.65 per mile, for a transcontinental run at GAE's present rate against an operating cost of about $1,300. For shorter hauls (as on the New York-Chicago route) income would amount to $560 against an operating cost of $365.

Also under consideration are TWA's five Consolidated Fleetster 20-As, single-engined ships which can carry only 1,800 lbs. payload, but are cheaper to operate than the Fords—and faster. Both types are at present being flown on test runs to determine cost of operation and general suitability.

The biggest difficulty will be to fill planes on the West to East run, as more express flies West than comes the other way. To solve this problem the line is negotiating for contracts from West Coast shippers of perishable goods.

THE ALL-METAL AERONEER 1-B

is completed, and is having its flight tests on the West Coast. Here the convertible cockpit cover has been removed. It is the product of the Aero Engineering Corp.

Transatlantic

British and PAA to operate New York-Bermuda service in fall

ONE MORE STEP in the international race for scheduled North Atlantic service was taken July 15 when the British Air Minister, Viscount Swinton, announced that a five-year agreement with Imperial Airways had been made for weekly New York-Bermuda service. It will start sometime in the fall, and will be operated in conjunction with Pan American.

To finance the venture, the British Government has provided an annual subsidy of £18,000, and a capital grant (to the government of Bermuda) of £34,500 for purchase of a ship. British contribution for equipment will be one of the Short Empire Flying Boats, now building.

Pan American's share of the service will probably be flown with a slightly larger version of the famous Sikorsky S-42 which blazed the Pacific trail. These boats, known as S-42-Bs, are building at Bridgeport now. They will weigh 20 tons gross, instead of the 19 tons of the Pan American Clipper.

Though the Bermuda service will not necessarily be part of the proposed transoceanic line, it will provide a good workshop to test Atlantic flying conditions.

ON THE BOTTOM

● Late in the afternoon, air looks heavy. Sunlight—streaming down through it—looks much the same as sunlight through water. It reminds you again that man is a deep-air animal—that he walks the bottom—and flies only a little above the bottom of the sea of air.

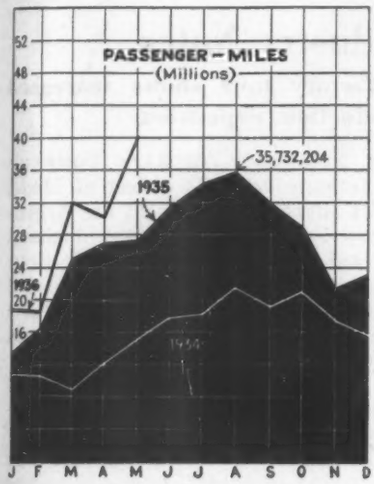
Man and all his engines are high pressure mechanisms—things which could not operate in the ether above our sea of air—which operate less and less efficiently as we move up from our natural habitat on the bottom.

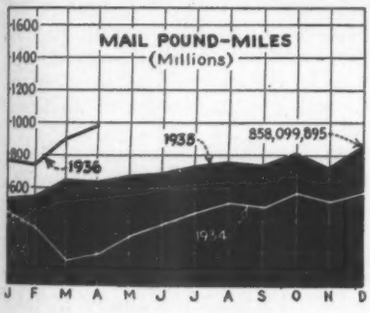
Supercharging compensates somewhat for the lessened pressures of higher altitudes—but not entirely. All aviation engines today are capable of producing more power at sea level than at 10,000 feet. All are capable of producing more power when the barometer is at 31 than when it is at 21.

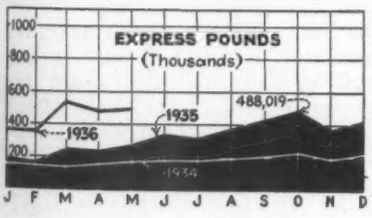
It is this fact that makes each increment of added power so valuable to aviation—that makes the potential power of high octane fuels vital to the industry today—and tomorrow. Ethyl Gasoline Corporation, Chrysler Building, New York City.

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







Balloon Battle

Goodyear entrant wins national race; Army balloon burns

THE 24TH Annual National Balloon Race came to a close at Denver, Col., July 5 with disappointing results: one broken back, one ruined balloon, no records.

Six 35,000 cu.ft. bags were entered: Army, piloted by Capt. Haynie McCormick; two for the Navy, piloted by Lieut. R. F. Tyler and Lieut. F. H. Gilmer; Goodyear Tire and Rubber Company, Frank A. Trotter; Great Lakes Exposition, Milford Vanik, and the Detroit Balloon Club, Roy S. Cunningham.

First mishap was to the Detroit entry, which, on the afternoon of the race's start, was ripped in a wind flurry and eliminated. The other five got off all right, drifted slowly into the northeast.

The Army entrant didn't remain up very long. After being becalmed 50 miles north of Denver for several hours during the night, it began to drift south, then west toward the Rockies. A drag rope was thrown out to retard its progress. Then a sudden down draft hurled it into a hillside. McCormick and his aid, Lieut. John A. Tarro, were thrown clear just before the bag burst into flames and came crashing down on the basket. The flight came to an end only 35 miles from Denver.

The Navy balloon came down 50 miles from Denver, but came down so hard the basket bounced 30 ft. in the air. Pilot Gilmer was thrown out, apparently uninjured. He helped pack up the balloon, then next day went to the hospital, to discover he had a broken vertebra.

Only entrant to get out of the State, and the apparent winner of the race, was the Goodyear balloon. It landed at Presho, S. D., 385 miles from Denver. This was far from the 571-mile national record, standing since 1927.

Airline Map Expands

Two new far west services organized. New equipment for Hanford. Four and a half days to Buenos Aires

A SCHEDULE speed-up that went into effect July 16 will bring airmail from Buenos Aires to New York in 4½ days over Pan American-Grace's South American west coast route. This cuts about a day from the old schedules. Pan American service down the east coast to Rio de Janiero will be increased from once a week to twice a week.

June 26 American Airlines put the first of its new Douglas DST Flagships into service on a non-stop New York-Chicago run. Two round trips a day are being flown, with the schedule calling for a four hours and 45 minutes flight westbound, three hours and 55 minutes eastbound. The ships are carrying fourteen passengers. When American's full complement of twenty of the big Douglases is delivered, the eight DST's (sleepers) will be transferred to the transcontinental run for overnight service. The rest will be used as day planes. Flagships for the seven daily New York-Boston round trips are fitted for twenty passengers.

July 8 marked the finish of 1,000,000 miles of flying for Boston-Maine Airways. Since 1933, 25,225 passengers have been carried without accident.

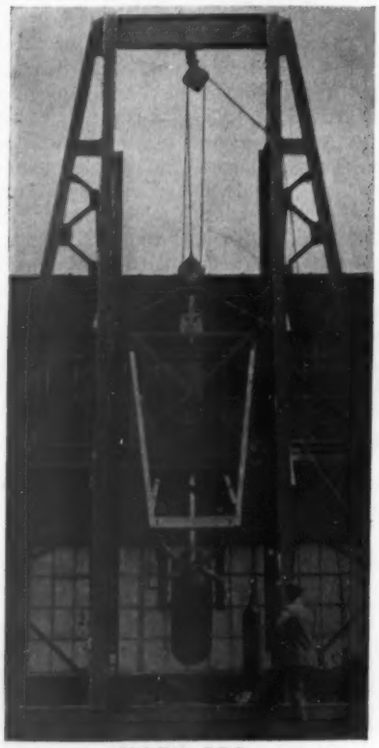
Capital Airlines, Inc., has been formed at Boise to operate one round trip a day between Boise and Pocatello, Idaho. Flying equipment will be a Beechcraft.

Central Airlines has added a fifth daily round trip on its Detroit-Washington route.

Permission for passenger service between Chicago and St. Louis by way of Peoria and Springfield, Ill., has been granted Chicago and Southern by the Illinois Commerce Commission. One round trip daily is planned.

The ICC has reassigned for hearing on Aug. 10 Delta's petition for an increase in mail pay. The case was originally scheduled for July 13. Also postponed, until Sept. 15, is the hearing on Eastern's complaint that American was violating the air mail act by maintaining passenger service between Newark and Washington.

Hanford Airlines, control of which has just been bought by Thomas Fortune Ryan III, will put 10-passenger Lockheed Electras in service on its Kansas City-Twin Cities run, cutting two and a half hours from former flying time. General offices and shops have been moved from Sioux City, Iowa, to Kansas City. Officers of the company: A. S. Hanford, president;



TEST JIG
for Boeing wheels. With loads of 16,000 lb., wheel assembly and Goodyear tire withstand impacts of 40 tons.

Thomas Fortune Ryan III, executive vice-president; J. W. Miller, vice-president and general manager; J. C. Collins, secretary-treasurer.

Inter-Island Airways, of Hawaii, has won from the ICC an increase in mail pay from 19.5 cents to 25 cents per airplane-mile over its 330-mile route.

Mountain Airways Corporation, with headquarters at Rawlins, Wyoming, has been formed to provide daily service between Billings, Montana, and Salt Lake City, and a connecting service between Rawlins and Denver. Maintenance base will be at Rawlins. Officers are: W. G. Finley, president; A. L. Sherwood, vice-president; M. Wahl, secretary-treasurer, and Fred Wahl, general manager. Maintenance will be under the supervision of Richard A. Wahl.

Pennsylvania set a new traffic record in May by carrying 5,807 passengers over the Washington-Detroit-Milwaukee route, an increase of more than 40 per cent over April. W. S. Rosenberger, operations manager, has reported that seven new radio stations, supplied by the RCA laboratories, will be installed at Washington, Pittsburgh, Akron, Cleveland, Detroit, Grand Rapids and Milwaukee.

W. A. Patterson, United Air Lines president, has announced that the company will purchase five additional Douglas DC-3's at $103,000 each, bringing the total to 15. A sixth daily round trip schedule has been added on the mid-continent coast-to-coast route.

Orders, Organization

50 Consolidateds for Navy. Army orders ships from Curtiss, Lockheed, Stearman. Air base for Alaska

THE NAVY seems to be going in for bombers. In June 191 dive bombers and scout bombers were ordered from Curtiss, Northrop, and Chance Vought. Then last month came an order for 50 flying boat patrol bombers (VPB), at a total cost of $4,898,000. It went to Consolidated Aircraft, already building 60 of the XP3Y type flying boat for the Navy. Engine installations for the new flying boats have not yet been specified by the Navy.

The month's Army orders were more diversified. July 23 Assistant Secretary of War Woodring announced the award of a $1,259,235 contract to Curtiss Aeroplane and Motor. It calls for an unannounced number—"sufficient . . . to provide for a thorough service test"—of Curtiss YA18s, two-engined, all-metal, midwing monoplane attack ships. They are said to be the world's only twin-engined attacks. Wright 1,000 hp. G-Cyclones (page 37) will provide power. Landing gear is retractable. The War Department's release says it is "generally credited with being the fastest two-engined military airplane built to date."

The second Army order went to Lockheed, and was for three Electras, at a cost of about $150,000. They are scheduled for delivery in August and September. Order No. 3 in the series, to Stearman, was for 50 primary trainers, at a cost of $329,659.

Another Army item of interest concerns the Wilcox bill, passed more than a year ago, to establish an indeterminate number of air bases about the country. They would be to permit rapid mobilization of a hypothetical 1,000-plane air force. The Army has set up a board of three officers to select a site for the first of these bases near Fairbanks, Alaska. The board consists of Lieut. Col. Wilmot A. Danielson, Quartermaster Corps.; Major Otto G. Trunk, Air Corps, and Major Albro L. Parsons, Medical Corps.

They will be supplied with plans of the layout desired, and other detailed instructions. Principal item to be considered will be the problem of an adequate foundation to withstand the heavy pounding of landing bombers. The Fairbanks base is considered to be a branch of the general base for the northwest, as yet unlocated. It will form an Alaskan central supply depot for fuel, ammunition, and servicing, though planes will actually be based at smaller surrounding fields for the different divisions of the GHQ Air Force, so as to avoid the danger of concentrating the whole force in one spot. The Alaskan base will probably not be finished before 1939. Although definite plans are not yet drawn, it is indicated that eight such bases, in all, will be constructed, each designed to accommodate a swift concentration of the entire air force.

Industry Notes

A factory tour shows increased production, expansion

THE STEARMAN AIRCRAFT COMPANY has recently delivered a fleet of Model 87 D1 advanced trainers to the Argentine. They are two-place biplanes powered by 320 hp. Model T1B Pratt & Whitney Wasp Jrs., and equipped with Hamilton Standard adjustable pitch propellers. Some are equipped with Edo floats for water service.

Up till July 1, WRIGHT AERONAUTICAL had received orders for more than 1,000,000 hp. from about 1,300 Cyclone and Whirlwind engines. Of these, more than 1,000 were Cyclones—432 of them the new 1,000 hp. Gs for installation in the 82 Douglas and 13 Boeing bombers now building for the Army. In civilian use, at least 40 of the Gs will go into American Airlines' fleet of 20 Douglas Flagships.

ENGEL AIRCRAFT SPECIALTIES have moved their shops from Glendale, Cal., to their own building in Escondido. The first of two units, including spinning machine, drop hammer, and power hammer, have been set up. It is planned to install additional machinery to take care of increased business.

The STEARMAN-HAMMOND AIRCRAFT CORPORATION has been formed in San Francisco, Cal., to manufacture the Hammond Model Y, one of the planes being tested by the Development Section, Bureau of Air Commerce, in the Bureau's quest for a safe, inexpensive plane for large-scale production. Heading the organization are Dean B. Hammond, Lloyd Stearman, and Samuel Metzger.

SEVERSKY AIRCRAFT, in compliance with requests from those countries, will submit sample planes to China, Brazil and the Argentine. To China will go an amphibian fighter; to South America a modification of the single-seat pursuit ordered by the U. S. Army.

SEVERSKY TYPES

from amphibian to trainer line up in front of the factory. All bear the family stamp.

Across

THE SPEARHEAD OF THE WORLD

Flying the trans-Andean route between Santiago, Chile, and Buenos Aires, in the Argentine, is but an incident in the log of Pan American Grace. • Across the spectacular stretch which lies in the shadow of the highest mountain ranges of the Western Hemisphere, Pan American makes the run in five hours . . . in Douglas Transports. • On more than 7000 miles of their far-flung system, Pan American and Pan American Grace Airways fly these familiar Douglas Transports . . . which have given the airways of the world more luxury, more security and more speed than has ever been offered in transportation before. • Douglas Aircraft Company, Inc., Santa Monica, Calif.

DOUGLAS

WHEREVER YOU GO . . TRAVEL VIA LUXURIOUS DOUGLAS EQUIPMENT

IN AMERICA . . . On American Airlines, Inc. . . . Eastern Airlines Pan American Airways . . . T. W. A., Inc., and Wilmington-Catalina Airline, Ltd.

IN THE ORIENT . . . On Japan Air Transport, China National Aviation Corporation, and K. N. I. L. M. in the Netherlands Indies.

IN SOUTH AMERICA . . . On Pan-American Grace Airways.

IN EUROPE . . . Deutsche Lufthansa in Germany; K. L. M. in the Netherlands; L. A. P. E. in Spain; L O T in Poland; C. L. S. in Czechoslovakia; Avio Linee Italiene in Italy; and Swissair in Switzerland.

IN AUSTRALIA . . . Holyman's Airways.

From faltering flight

TO RIGID AIR LINE SCHEDULE

Roebling has pioneered in the development of Wire Aircraft Products

TODAY and since the inception of the aviation industry, Roebling keeps step with an industry whose constant watchword has been Progress. Most principal plane builders now turn to Roebling for the solution of their wire and cable problems. And in the years to come Roebling will continue to pioneer in the improvement of wire aircraft products.

Roebling Wire Aircraft Products include:—*Tinned Aircraft Wire; 19-wire Aircraft Strand, Tinned or Galvanized; Aircraft Cord {6 x 7, 7 x 7, 7 x 19}, Tinned and Galvanized; Ferrules and Thimbles; Serving and Locking Wires; Control Strand and Casing; Electrical Power and Lighting Cables; Gas and Electric Welding Wire.*

John A. Roebling's Sons Co., Trenton, N. J.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

Last month an order for 400 Continental A 40-3 motors for the TAYLOR AIRCRAFT COMPANY was announced. This month an order more than twice as large—for 1,050—is recorded. Fifty of them will be equipped, for experimental purposes, with dual ignition systems.

Cub production for the year is scheduled around 600. In the first five months that the new models were in production—from Feb. 1 to July 1—211 Cubs came off the production line. This nearly equalled 1935's record 230 planes, which was 20 per cent of all non-military planes produced. This year's July production totaled 70, all that were produced in the whole year of 1934.

RANGER ENGINEERING CORPORATION, of Farmingdale, N. Y., has launched a production program for 100 of the new 145 hp. Model 6-390-D Ranger engines, an improvement over the B model, of which 25 were produced last year. Total production will go to the FAIRCHILD AIRCRAFT CORPORATION, of Hagerstown, Md., for installation in the 1936 Fairchild 24s.

UNITED AIRCRAFT CORPORATION has 4,700 employees on the payroll, as compared with 3,800 a year ago.

B. D. DeWeese, president of the STINSON AIRCRAFT CORPORATION, has announced a record of seven million miles flown in Stinson Reliants in the first six months of this year without a single fatality to pilots or passengers.

Canadian Airways, Ltd., has ordered two 10-passenger LOCKHEED Electras for experimental flying prior to the letting of contracts for trans-Canada mail service. The ships cost about $50,000 each. Another Electra has gone to the recently reorganized Hanford Airlines.

Commercial production was scheduled to start early in July at the ARROW AIRPLANE & MOTOR CORP. plant in Lincoln, Neb. Arrow Model F, ATC 601 for which was issued last April, is powered with a modified Ford V-8 engine delivering 82 hp. According to F. Pace Woods, executive vice-president of the company, a production schedule of four planes a day will be reached by fall.

The Summer meeting of the Maintenance Committee of the Air Transport Association was held July 9, 10, 11 at the Hollywood Plaza Hotel, Hollywood, Cal. It was chairmanned by TWA's maintenance chief, W. A. Hamilton. The Committee's secretary is Fowler W. Barker, of the A. T. A.

Recently came word that after several months of negotiation, the Alliance, Ohio, Chamber of Commerce has secured for TAYLORCRAFT AVIATION COMPANY the 60x300 ft. factory in Alliance formerly occupied by the Argo Airplane Co. There the company is being set up with Mr. Taylor at its head, K. W. Tibbits as production manager, and L. W. Salchow in charge of welding. Jigs, equipment, planes and parts in process have been moved to the new location, and facilities for production are ready. The Taylorcraft is a two-place, side-by-side high-wing monoplane powered with a Continental motor. It will sell for $1,495, and a number of orders are reported.

To power Douglas bombers, the War Department has ordered 150 Wright Cyclone R-1820-G engines. rated at 1,000 hp. at the take-off (see page 37). Total contract price is $1,327,190.

Further, Faster

Army fliers capture amphibian distance; Italians claim eight

Two FAI amphibian records fell under an attack by the Army Air Corps June 29. In a 1,425 mile non-stop flight from San Juan, Puerto Rico, to Langley Field, Va., Maj. Gen. Frank M. Andrews, commander of the GHQ Air Force, and Maj.-Gen. Frank R. McCoy, commander of the army's second corps area, broke by nearly 400 miles the record set last January by another Air Corps plane of the same type—a Cyclone-powered Douglas O-A-5 amphibian. The trip, against headwinds, was made in eleven hours, nine minutes. Second record for the flight was the 1,000 kilometer speed record established by Harry Richman in February, 1935.

A few days later an Italian announcement claimed eight world seaplane records, set in a tri-motored Cant Z. 506. The records are for speed over 1,000 and 2,000 kilometer (621 and 1,242 mile) courses, empty and with loads of 1,102, 2,204, and 4,409 pounds. The ship clocked 190 m.p.h. over the 1,000 kilometer course, 194 m.p.h. over the 2,000 kilometer course.

In the feminine category, Mlle. Maryse Hilz, flying a Potez 50, broke both the French men's and women's world altitude records at Villacoublay, France, June 23. She reached a height of 46,947 ft. The men's world record is held by Renato Donati, of Italy, at 47,352 ft.

Calendar

Aug. 1—Western Canada Annual Air Show, Vancouver, B. C.

Aug. 30—James Gordon Bennett Balloon Race, Warsaw, Poland.

Sept. 4-5-6-7—National Air Races, Los Angeles, Cal.

Sept. 23-26—Sixth Annual Convention, National Association of State Aviation Officials, Hotel Bond, Hartford, Conn.

Oct. 15-16-17—National Aircraft Production Meeting of the S.A.E., Ambassador Hotel, Los Angeles.

Oct. 25—Paris-Saigon Air Race.

Jan. 28-Feb. 6, 1937—Aircraft Show, New York.

Financial

Capital expansion. Profits for Bendix, Boeing

BELL AIRCRAFT Corp. directors have approved a refinancing plan for acquisition of $500,000 in new working capital for a 70,000 sq.ft. factory expansion. New stock would be issued in exchange for present preferred and common stock. The company, organized a year ago, has $1,300,000 in unfilled orders, employs 450 men at the old Consolidated Aircraft plant at Buffalo.

Airplane & Marine Direction Finder Corp. (Lindenhurst, N. Y.) has filed a petition for reorganization. Assets are listed at $739,240, including $400,000 in patents, and liabilities are the same. Capital stock consists of 1,000 shares of 6 per cent preferred, with a par value of $100 each, and 100,000 shares of common, with no par value.

Consolidated Aircraft is offering exchange rights to stockholders of record July 16. Three dollar preferred stock, at $50 a share, will be available in the ratio of one share for each 25 shares of common now held. The rights expire Aug. 14.

Douglas Aircraft is offered 93,480 shares of new capital stock to holders of record July 13, at the ratio of one share for each five held. The price was $45. Stock not subscribed when the rights expired Aug. 3 was offered to the public by underwriters.

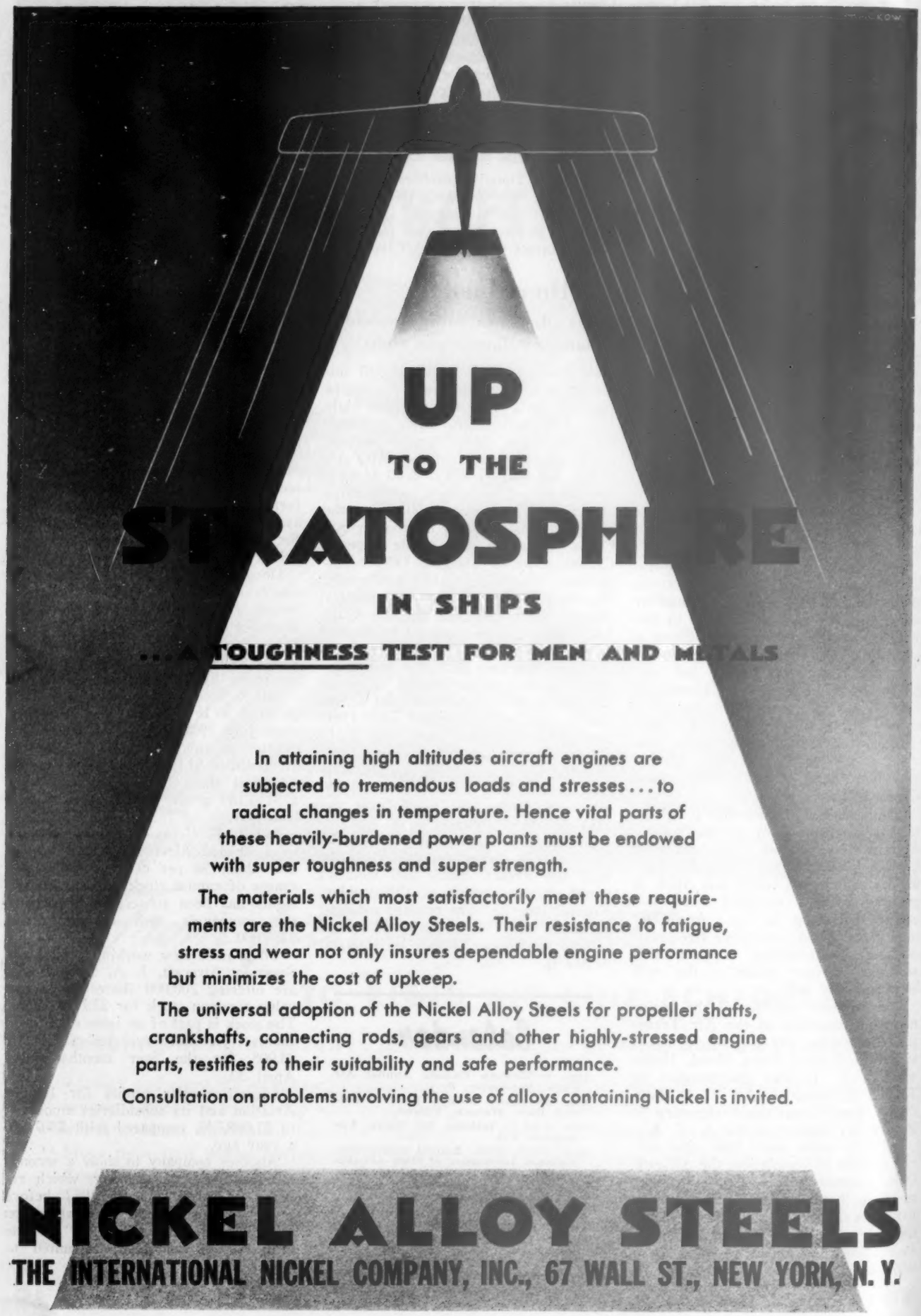
July 6 Ex-Cell-O Aircraft and Tool declared a 15 cent dividend, the first since July, 1930. Profit for the second quarter of this year, ended June 30, amounted to $131,655, equal to 34 cents a capital share. This compares with a $114,169 profit for the same period last year.

Robert E. Gross, president-treasurer of Lockheed Aircraft, has announced that about 98 per cent of the 63,534 shares of capital stock offered through rights has been subscribed, increasing the company's cash reserve about $350,000.

To provide new working capital for Seversky Aircraft, J. A. Sisto & Co. are offering 200,000 shares of $1 par value common stock for $3.75 a share. The stock is part of an issue of 840,000 shares. Seversky reported a loss of $3,905 for the four months ended April 30.

Second quarter profits for Bendix Aviation and its subsidiaries amounted to $1,008,740, compared with $807,646 a year ago.

Another company to show a second-quarter profit was Boeing, which reported a profit of $133,982 before provision for federal surcharges on undistributed earnings. Loss for the same period last year amounted to $224,558.


UP
TO THE
STRATOSPHERE
IN SHIPS
... A TOUGHNESS TEST FOR MEN AND METALS
In attaining high altitudes aircraft engines are subjected to tremendous loads and stresses . . . to radical changes in temperature. Hence vital parts of these heavily-burdened power plants must be endowed with super toughness and super strength.
The materials which most satisfactorily meet these requirements are the Nickel Alloy Steels. Their resistance to fatigue, stress and wear not only insures dependable engine performance but minimizes the cost of upkeep.
The universal adoption of the Nickel Alloy Steels for propeller shafts, crankshafts, connecting rods, gears and other highly-stressed engine parts, testifies to their suitability and safe performance.
Consultation on problems involving the use of alloys containing Nickel is invited.
NICKEL ALLOY STEELS
THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Schools, Services, and Airports

A state-by-state tour of the flying fields

• ALABAMA — BIRMINGHAM's Sixth Annual Air Carnival, June 6-7, drew 10,000 spectators the first day. The BIRMINGHAM Aero Club turned over a $500 profit to the city. . . . MOBILE is considering $102,000 of WPA airport improvements, including additional runways, lighting, and enlargement of the administration building.

• ARIZONA—The WPA is installing an air marker at NOGALES to indicate the direction to the airport.

• ARKANSAS—A three-day air show, sponsored by the 154th Observation Squadron, was held at LITTLE ROCK Airport early in July. Coincident with the show, the squadron's new hangar was dedicated.

• CALIFORNIA—An air show featuring parachute jumps was scheduled early in June for Arlington Airport, RIVERSIDE. . . . The BAKERSFIELD Chamber of Commerce is considering the erection of a radio marker beacon at KERN County Airport. . . . The WPA has allotted $123,000 for two improvement projects at OAKLAND Municipal Airport. One project calls for installation of additional fire control mains, the other for draining, leveling and surfacing a 500x5,000-ft. runway, and relocating present boundary lights. . . . The Aviation Country Club of California, Inc., sponsored an air tour from Los ANGELES to SONORA late in May. Forty-six planes and 131 people participated. Winner of first place in the Navigation Efficiency Test was Miss Frances Brayton, who flew a Kinner. . . . Tex Rankin, PORTLAND, ORE., acrobatic flyer, has joined Aircraft Industries, Inc., Stinson distributors in the Southwest based at Grand Central Air Terminal, GLENDALE.

• CONNECTICUT — The reorganized CONNECTICUT Aero Club, at a meeting in BRIDGEPORT late in June, urged establishment of a suitable airport in the city. Club president: W. Parker Seeley. . . . The Bureau of Air Commerce has given final approval to a $100,000 WPA project for construction of an administration building at Brainard Field, HARTFORD. It is the second part of a three-phase program for rehabilitation of the field after the spring floods.

• COLORADO—The Bureau of Air Commerce will establish an emergency landing field on 122 acres of land 9 miles west of GREELEY which it has leased. . . . Stuart V. Wandell has been named manager of the COLORADO SPRINGS Municipal Airport, to succeed Max Piele, who resigned. Wandell holds both a transport and a mechanic's license.

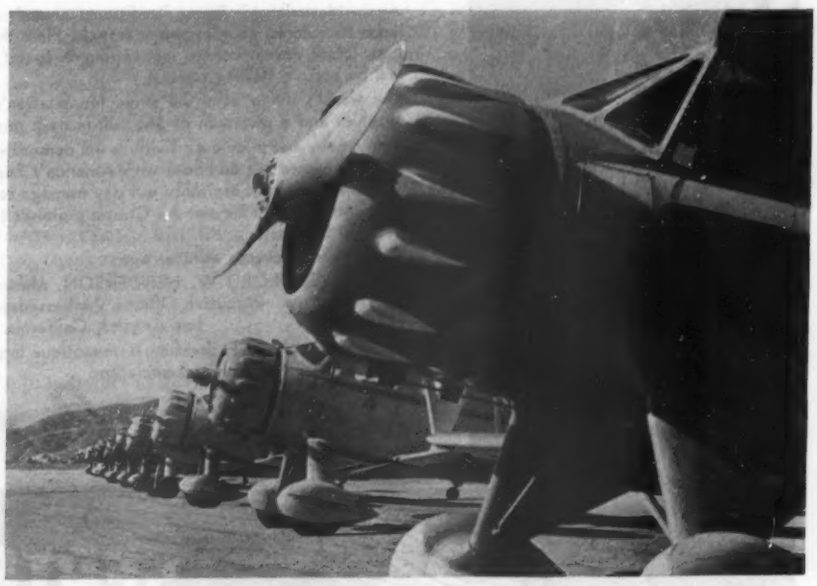
• DELAWARE—A radio beacon is being installed at the Du Pont Airport, WILMINGTON. . . . The Rehoboth Air Service, Inc., has established an airport at REHOBOTH BEACH, and has erected a hangar and office. A Taylor Cub will be used for student instruction. . . . Air Services, Inc., has erected a new hangar at Bellanca Field, NEW CASTLE.

• FLORIDA—At the annual meeting, late in June, of the MIAMI Aero Club, the following officers were elected: president, Arthur E. Curtis; vice-president, Lewis Sevier; treasurer, Royce Chalmers; secretary, D. Van Orsdel. The club is considering acquisition of its fifth plane. . . . MIAMI is considering enlargement and improvement of the Miami Municipal Airport. Included in present plans is an addition of 700 acres and rerouting of highways between city and airport.

• GEORGIA—Improvement work at SWAINSBORO Airport is reported well advanced. . . . Topsoil is being spread on the MACON Airport. Later runways and a hangar will be constructed.

• IDAHO—BOISE is considering construction of a mile-square airport with WPA funds. . . . The WPA has released $16,000 for improvement work at BURLEY Municipal Airport. Principal item will be a new hangar, large enough for three planes. . . . I. R. Johnston, Josephine E. Johnston, and J. Ward Arney have formed a company known as Air Transport, Inc., at COEUR D'ALENE. A Bellanca will be used for passenger and freight transport. Pilot: Ben Bieber.

• ILLINOIS—Nelson Weber, Stanley Kluzek and Frank Fleck have established the Lake Springfield Airport, SPRINGFIELD. East-west and north-south runways have been constructed, and a hangar is also planned. Kluzek, who is chief pilot at the field, and Weber will use their own plane for student instruction, and Fleck will bring his Taylor Cub to the field. . . . Flood lights have been installed at the DANVILLE Municipal Airport by the eight ship owners who hangar their planes at the field. The steel framework of a six-plane hangar is already



WACOS LINE UP

at Union Air Terminal, Burbank, Cal., where all twelve of them, privately owned, are regularly hangared.

All Wings Westward !

NATIONAL AIR RACES
LOS ANGELES

16th Annual World's Premier
AIR CLASSIC
Los Angeles Municipal Airport
(INGLEWOOD)

$66,300.00 IN PRIZES

Again National Air Races, traditional annual rendezvous of aviation, holds its colorful competitive spectacle. Here the most advanced findings, latest developments, innovations in speed, endurance and safety will be seen in thrilling contest.

The world's flying aces will strive for aviation's most coveted racing trophies and a minimum of $66,300 in cash prizes.

Army, navy and marine air divisions will demonstrate tactical maneuvers. Foreign planes will compete with America's finest. For 4 thrilling days California's warm hospitality will pay homage to the great air industry. This 16th World's Premier Air Classic promises to excell every air spectacle of the past.

For details of events write or wire

CLIFFORD W. HENDERSON, Managing Director
Executive Offices, Ambassador Hotel
Los Angeles, California

Held under rules of Federation Aeronautique Internationale. Sanctioned by National Aeronautic Association.

Be there!

4 BIG DAYS

SEPTEMBER 4,5,6,7.

completed. Other work at the field includes drainage and sodding. . . . Ed Weisbruch and Hallie O'Brien, of the PEORIA Aero Sales Co., have been named distributors for Taylor Cubs. By early June three planes had been sold . . . Improvement work employing 1,000 men at the CHICAGO Municipal Airport was about 60 per cent finished early in July. Work includes surfacing and widening of the runways, and installation of a drainage system.

• INDIANA—MUNCIE Airport, which is state distributor, has two new Aeroncas, one of which belongs to the MARION Aviation Club. . . . The new boundary lighting system at Paul Baer Municipal Field, FORT WAYNE, was dedicated late in June. Capt. Clarence F. Cornish is manager of the field. . . . ROCHESTER has received approval for an $8,500 bond issue for purchase of an airport to make the city eligible for $47,000 in WPA funds alloted for its improvement. . . . THE INDIANA Aircraft Trades Association sponsored the Eighth Annual Indiana Air Tour, June 22-28. The tour, which had 52 planes participating, visited 20 cities, making overnight stops at FRENCH LICK, TERRE HAUTE, SOUTH BEND, CULVER, FINDLAY (Ohio), and FORT WAYNE. Herbert O. Fisher was tour director. . . . INDIANAPOLIS has filed an application for a $224,800 WPA grant for construction of a fifteen-plane hangar, extension of the northwest-southeast runway, extension of the blind landing lane and construction of a radio control tower.

• IOWA—A crowd of 15,000 attended on the last day of a two-day air show sponsored at BURLINGTON by the Junior Chamber of Commerce. The show brought 30 planes to the municipal airport. . . . Dedication ceremonies for the DECORAH Municipal Airport were set for late in June.

• KANSAS—Most of the work on WICHITA Municipal Airport's $125,000 improvement project has been completed. The taxi strip in front of the administration building has been widened 75 ft. and lengthened 70 ft. The east-west runway has been graded and grass sown.

• KENTUCKY—GLASGOW's municipal field was dedicated late in June, and named Winn Davis Airport. As part of the ceremony, the 1936 Good Will Air Tour of the KENTUCKY Aero Club and the LOUISVILLE Junior Board of Trade arrived on the field with 23 planes.

• MAINE—The BANGOR airport has been designated an airport of entry until June 26, 1937.

• MARYLAND—The CUMBERLAND Airport Commission is seeking $10,500 from the WPA for improvements to CUMBERLAND Airport. . . . The HAGERSTOWN City Council has voted to file application for WPA assistance in the construction of concrete runways, a new hangar, and installation of floodlighting at the municipal airport. Cost to the city is estimated at about $12,000.

• MASSACHUSETTS — A second hangar is being built on the HINGHAM Airport, which will accommodate ten planes and provide overhaul and repair shops. . . . Cape Cod Seaplanes, Inc., basing at Coonamessett Lake, FALMOUTH, are operating four ships on floats on the NEW BEDFORD, WOOD'S HOLE, MARTHA'S VINEYARD, NANTUCKET run. Guy A. Ham, Jr., is in charge of the service, with Nelson Jones as chief of maintenance. The company also operates FALMOUTH Airport, where they have purchased the hangar and keep a plane for student instruction. In addition to the Waco, Fleetster, Fairchild 71, and Rearwin, a float-equipped Stinson has been ordered. . . . Inter-City Airlines of BOSTON has purchased a Wasp-powered Travel Air from the La Touraine Coffee Co. . . . WESTFIELD CITY Council has voted an $8,000 appropriation for the purchase of Barnes Airport and adjoining tracts for the establishment of a municipal airport. Municipal ownership will make the field eligible for a WPA grant of $85,000. . . . Eight planes participated in a meet held by the DEDHAM Country and Polo Club late in June.

• MICHIGAN—Two new planes have been added to the fleet regularly hangared at Bishop Airport, FLINT. The airport's new $7,000 lighting system was completed last month. . . . The new hangar on the Capitol City State Airport, LANSING, was scheduled to be ready for use late in July. Federal funds in excess of $200,000 have been spent for improvements at the field. . . . The Wayne County Board of Supervisors has approved appropriation of $50,000 to enlarge the hangar at WAYNE COUNTY Airport. . . . The Mattson Flying Service, SAULT STE. MARIE Airport, has purchased a new Travel Air. . . . Barr-Stanislaw, Inc., DETROIT City Airport, has been named distributor for Taylor Cubs in Wisconsin as well as Michigan. . . . The Lawrence Institute of Technology team won the gliding contest at the second annual National Intercollegiate Flying Club meet at Wayne County Airport, DETROIT, June 19. Powered plane honors were taken the next day by Stanford University, with John Park winning individual high honors by scoring eleven points. . . . The International Wakefield Trophy for model planes, contested for at Wayne County Airport, DETROIT, early in July, was won by Albert A. Judge of the British team with a flight of 4 minutes 9.9 seconds. This is the fifth British victory in the nine years the trophy has been contested.

• MINNESOTA — A $250,000 improvement project, involving the construction of three concrete runways on Wold-Chamberlain Field, MINNEAPOLIS' Municipal Airport, is under way. The project is being financed by a $200,000 WPA allotment, plus a $50,000 city bond issue. Runways will be 150 ft. wide, two of them 3,000 ft. long, the other 3,500 ft.

• MISSISSIPPI — Mississippi Airways, based at JACKSON Municipal Airport, have purchased a new Jacobs-powered Waco, which will be used for charter work. Manager of the company is J. E. Howell. . . . A third runway has been added to the list of scheduled improvements at CORINTH Airport.

• MISSOURI—W. W. Kratz, located at Lambert-St. Louis Field, ST. LOUIS, reports the sale of six Stinson trimotors formerly operated by Chicago & Southern. . . . WPA improvement projects in Missouri include: JOPLIN, $64,316, for runway resurfacing and draining and construction of a hangar; Lambert-ST. LOUIS, $9,657 for lights and wind indicator; COLUMBIA, $2,403, for construction of a waiting room; POPLAR BLUFF, $13,091 for runways and drainage work. . . . The Aviation Credit Corporation of St. Louis is being formed at ST. LOUIS for the purpose of financing plane purchases and repairs. Officers: W. R. Shillington, president; W. W. Kratz (president of the St. Louis Flying Service) vice-president and general manager; Dumont Dempsey, treasurer, and Lazear Baker, secretary.

• MONTANA — Installation of a lighting system and improvements to the hangar have been completed at KALISPELL Municipal Airport. . . . Two WPA projects at the HELENA Municipal Airport call for improvements on the landing field and construction of an administration building. Total cost will be $23,798.

• NEBRASKA—The HASTINGS City Council has approved a WPA improvement program for the municipal airport to cost from $16,000 to $20,000. Plans include flood lighting, boundary and obstruction lights, runways, drainage and grading.

• NEW HAMPSHIRE—Frank Auernig, chief pilot of CONCORD Air Serv-

"Airline Technician"

One of 10 famous BOEING SCHOOL courses

As one of its 10 outstanding courses Boeing School offers only one "restricted" ground course, the 9-month "Airline Technician." This is a post-graduate course for men with engineering college degrees. It supplements your technical training with airline and factory shop and laboratory practice, construction and maintenance procedure . . . gives you the background of practical experience demanded of a Design, Air Transport or Operations Engineer.

United Air Lines stands behind the Boeing School. Officials of United confer with Boeing School faculty . . . help create courses based on the practical knowledge of the world's most experienced airline.

In the "Airline Technician" course, for example, you get 1392 close-packed hours . . . selected from advanced Assembly and Shop work, Fabrications, Instruments, Power Plants, Design, advanced Airline Economy, Communications, Air Transport Principles and other subjects as outlined in the school Bulletin.

In Boeing School's 15 shops and laboratories you become familiar with air industry equipment of the latest type. Service work, seminar lectures and construction projects give you a thorough grasp of present day techniques, of coming trends in development and invention. In addition, you "major" in special elective subjects chosen to meet you future aims.

"Unrestricted" ground courses

The 12-month "Airline Mechanic," Boeing School's basic ground course, covers 59 subjects, prepares you for many types of jobs at airports, factories and on the lines.

The 24-month "Airline Operations"—the most complete ground training course available—offers a thorough preparation for communications, metals, instruments, engines, electrical, sales and administrative work . . . a sound background for such jobs as assistant field manager, field clerk, traffic man, and other semi-technical positions.

Send for NEW Bulletin today

There is a Boeing School course to prepare you for any field of aeronautics. New *Bulletin* describes ground and air courses, gives costs and enrollment requirements. Use coupon below.

SEVEN PILOT COURSES

Boeing School Pilot courses are outstanding. The 2-year "Airline Pilot and Operations" course is considered the most complete in America. Send coupon for details.

Next regular enrollment Sept. 28

BOEING SCHOOL OF AERONAUTICS

A division of UNITED AIR LINES

Department T-8, Airport, Oakland, California

Gentlemen: Without obligation, send me NEW 1936 Boeing School Bulletin, giving full information on courses indicated:

☐ Airline Pilot and Operations ☐ Amateur Pilot
☐ Airline Pilot ☐ Airline Mechanic
☐ Transport Pilot ☐ Airline Operations
☐ Limited Comm'l Pilot ☐ Airline Technician (For engineering graduates only)
☐ Private Pilot
☐ Special Airline Pilot (For Transport Pilots only)
☐ Home Study Courses (For those in the industry)

*Name*_____ *Age*_____

*Years in High School*_____ *Years in College*_____

*Address*_____ *Phone*_____

*City*_____ *State*_____

New McGRAW-HILL Aviation Books

Wood's TECHNICAL AERODYNAMICS

A simplified, practical treatment of the aerodynamics of airplanes, covering the basic principles of airplane flight, and emphasizing reliable technical data and their use in making calculations of airplane performance and stability. 330 pages, illustrated, $3.50.

Nelson's SEAPLANE DESIGN

Gives a wealth of important information and data covering the problems of aeronautics and marine design, without duplicating existing material on the respective subjects. Includes detailed sketches of typical seaplanes, flying boats, and separate float seaplanes of the latest type. 274 pages, illustrated, $3.50.

Younger's STRUCTURAL DESIGN OF METAL AIRPLANES

A complete guide to modern methods of designing all-metal airplanes, from general requirements and factors of airplane design, and design procedure, up to the latest developments available on the design of thin sheet metal airplane construction. 334 pages, illustrated, $4.00.

Prandtl-Tietjens' FUNDAMENTALS OF HYDRO- AND AEROMECHANICS

A concise treatment of hydrostatics and a more elaborate treatment of aerostatics. Treats in larger part of the so-called classical hydrodynamics. The trend throughout is to show a closer relationship between theoretical and experimental development. 270 pages, illustrated, $4.00.

Prandtl-Tietjens' APPLIED HYDRO- AND AEROMECHANICS

Begins with a discussion of the laws of mechanical similarity and the rules regarding model tests. Other topics covered are the resistance of bodies moving through fluids, streamlining, two-dimensional and three-dimensional airfoil theory, methods of measuring velocities, design of wind tunnels, methods of making visible flow lines, etc. 315 pages, illustrated, $4.00.

Send for these books for 10 days' examination

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.

Send me the books checked for 10 days' examination on approval. In 10 days I will pay for the books, plus few cents postage, or return them postpaid. (We pay postage on orders accompanied by remittance.)

☐ Wood—Technical Aerodynamics, $3.50
☐ Nelson—Seaplane Design, $3.50
☐ Younger—Structural Design of Metal Airplanes, $4.00
☐ Prandtl-Tietjens—Fundamentals of Hydro- and Aeromechanics, $4.00
☐ Prandtl-Tietjens—Applied Hydro- and Aeromechanics, $4.00

Name .....

Address .....

City and State .....

Position .....

Company .....Av. 8-36

(Books sent on approval in U. S. and Canada only.)

ice, Concord Municipal Airport, has equipped his Stinson with lights for night flying. The company's fleet was recently brought up to five with the purchase of a Kittyhawk.

• NEW JERSEY—Five planes carrying fifteen people took off from CALDWELL Airport late in June for an aerial picnic at Baltimore. . . . The NEW JERSEY State Aviation Association, formed less than three months ago, has a membership of nearly 500. Officers: Grove Webster, president; Russell C. Johns, vice-president; H. Myers Bogert, secretary-treasurer. . . . Maj. Robert L. Copsey has received permission from the Civil Service Commission to continue in his present position of technical adviser at NEWARK Airport until Oct. 1. . . . The Luscombe Airplane Development Corp. has received a three-year lease on the Mercer Municipal Airport, TRENTON.

• NEW YORK — Plans are being made for a third hangar at ROCHESTER Municipal Airport as a WPA project. It would cost $65,000, and bring the total allotted to the field up to $865,000. The two present hangars on the field are already filled to capacity with the 25 planes regularly based there. . . . F. B. Downing, Jr., manager of NIAGARA FALLS Municipal Airport, has bought a new four-place Stinson, which will be used for charter work. . . . ELMIRA is considering purchase of the American Airlines Airport. $29,500 has been included in the budget for the purchase. . . . At the second joint convention of the New York State Aviation Association and the New York State Airport Managers Association at BUFFALO, Max J. Pollet, president of the Aviation Association, favored nationwide federal regulation instead of state regulation. Nathaniel E. Duffy, Buffalo Airport manager, was chairman of the session. . . . BUFFALO is considering the development of an airport on GRAND ISLAND to supplement the present municipal airport.

• NORTH CAROLINA — The DURHAM City Council has voted $40,000 for acquisition of a 140 acre airport site north of the city. WPA assistance will be sought in its development. . . . A plan is reported to move the hangars at Miller Municipal Airport, WINSTON-SALEM, 2,500 ft. north of their present position, to bring them within 200 ft. of the highway. . . . CHARLOTTE is making plans for a complete lighting installation at the municipal airport.

• OHIO — The TOLEDO City Council has voted for acquisition of Transcontinental Airport, and is seeking means of raising the $60,000 required for its purchase. . . . Norton Airport, COLUMBUS, has been leased by the Midwest Aviation Corporation, of which George Clyde is president and general manager. . . . An air show sponsored by the TOLEDO *News-Bee* and featuring Lieut. Joseph C. Mackey and his Linco Aces in a program of stunt flying drew 50,000 spectators to Transcontinental Airport in June. The show was under the direction of Chet Fenton, airport manager.

• OKLAHOMA — Thirty-nine planes bearing about 80 passengers took part in the third annual Oklahoma State Air Tour, which started from TULSA June 13 and finished at OKLAHOMA CITY the next day. . . . WPA improvements at OKLAHOMA CITY Municipal Airport, to cost $161,770, include a new hangar and improvements in the landing area. . . . TULSA has $63,000 in WPA funds to complete runways and grade the field and provide drainage. . . . Increased flying activity has compelled Clyde Nuckols, operator of the Southwest Aviation Service Co. in the south hangar at OKLAHOMA CITY Municipal Airport, to expand his facilities. Norman Blake has been put in charge of the engine shop, which has been fully equipped. A radio department has been added under the direction of George Hales. Student instruction, for which a new Taylor Cub has been added to the fleet, is in charge of Haskell Shaw.

• OREGON — The Private Flyers Association held its second annual National Amateur Air Meet at EUGENE Airport late in June. . . . A committee has been appointed by the Governor to draw up plans for the second northwest aviation planning council, to be held at PORTLAND in November. Members: James Ford, SPOKANE; Harry K. Coffey, PORTLAND; W. R. Graham, BOISE; William Ferguson, HELENA, and Allan D. Greenwood, SALEM.

• PENNSYLVANIA — Almost 800 men are at work on HARRISBURG Airport under a $770,000 WPA project. When finished, the field will have three runways, 4,000, 3,900 and 3,600 ft. in length. . . . SOMERSET is considering purchase of the Webster Barron tract, north of the city, for development as a $167,000 WPA project. . . . The WPA has allotted $3,175 for airmarking in CAMBRIA, SOMERSET, BEDFORD and BLAIR counties. Twenty-four towns are included in the program. . . . CONNELLSVILLE is seeking condemnation of 400 acres of land for a county airport. . . . The DUBOIS City Council has moved to provide $17,500 to secure from the WPA $140,000 for improvement of DuBois Municipal Airport. . . . The WPA has allotted $102,850 for the improvement of WAYNESBURG Municipal Airport. . . . A $98,000 WPA project at WAYNESBORO Municipal Airport will provide a new 80x100 ft. hangar and two runways, 1,750 and 2,100 ft. long. . . . Charles Taylor has purchased a low-wing Aeronca, which will be based at the BROOKVILLE Airport.

• SOUTH CAROLINA—Another two months will be required to finish COLUMBIA's $138,000 WPA project, which will provide three runways and a lighting system. . . . Two of CHARLESTON Municipal Airport's three runways have been completed, and work on the third is progressing.

• TENNESSEE — The National Park Service has recommended establishment of an airport in the BUFFALO SPRINGS Fish and Game Preserve. Development is conditional on the State's acquiring the necessary land. . . . The first plane landed at NASHVILLE Municipal Airport late in June after the WPA had virtually completed a $750,000 improvement program. The three runways are 4,800, 4,500, and 3,200 ft. long. . . . Ben Douglas has been elected president of the Dawn Patrol, MEMPHIS. Other officers: Mervin Rosenbush, Jr., vice-president; Ray Mount, secretary-treasurer; Sam Nickey, Jr., business manager. . . . The State Highway Department is scheduled to undertake improvements at the CLARKSVILLE Airport.

• TEXAS — Air Activities, Inc., HOUSTON Municipal Airport, have recently sold three Fairchild 24s, for which they are State distributors. . . . The DALLAS City Council is considering a $500,000 bond issue for improvements at Love Field, to include enlargement, completion of the runways, and construction of an administration building. . . . The Bureau of Air Commerce has tentatively approved plans for the installation of a blind landing system at Meacham Field, FORT WORTH's Municipal Airport. . . . The American Legion sponsored an air show at the Tri-State fair grounds, AMARILLO, July 4. . . . The HOUSTON Junior Chamber of Commerce sponsored an Aviation Week early in June. The city is considering selection of a site and application for a WPA improvement fund for a municipal field a short distance from the heart of the city.

• UTAH—The Governor has appointed a committee to recommend laws relating to aviation in the State. Members are Arthur McFarlane, S. D. Thurman, B. F. Redman, E. A. Culbertson, G. P. Backman, and Calvin W. Rawlings of SALT LAKE CITY; M. R. Hovey of LOGAN; Clayton Jenkins, PROVO; Ezra Fjeldsted, Ira Huggins, and Parter T. Robbins, OGDEN; George A. Schultz, PRICE, and Dr.

AVIATION

VICE-PRESIDENT EARL PRUDDEN

of the Ryan School of Aeronautics gives some last-minute instructions to a student about to take off in one of the school's Great Lakes Trainers.

G. B. Gottfredson, RICHFIELD. . . . The SALT LAKE CITY Commission has purchased an additional 20 acres for the enlargement of Salt Lake Municipal Airport. . . . BEAVER CITY is planning construction of a mile-long airport to cost about $18,000. It will have a 60x60 ft. log hangar.

• VIRGINIA — A permanent 100-kilometer speed course has been laid out with its starting point at ENDLESS CAVERNS Airport. . . . The Flying Aces, under the sponsorship of the PETERSBURG Post of the American Legion, were scheduled to stage an air show late in June. . . .The WPA is building airports at PARKSLEY and GORDONSVILLE. . . . The Virginia Aeronautic Association sponsored an air show at the Meadowville Airport, near WARRENTON, in June. . . . H. P. Grim, of ROANOKE, is seeking a lease to operate STAUNTON Municipal Airport. . . . WPA airport improvement allotments in Virginia include $11,000 for ROANOKE and $9,950 for BRISTOL. Plans call for clearing, grading and landscaping. . . . W. T. McGalliard, of DANVILLE, has been elected president of the Virginia Aeronautic Association, succeeding A. W. Card of RICHMOND, who was named honorary president. The association held a meeting in Richmond late in June at which a program for the development of aviation in the State was discussed.

• WEST VIRGINIA — The WPA will install lighting equipment on PRINCETON Municipal Airport. . . . James Fette will be chief pilot at the reopened field at GLENDALE, near WHEELING. . . . A fuel tank and pump will be installed at PARKERSBURG Municipal Airport, MAPLEWOOD.

Schools

• The BOEING SCHOOL OF AERONAUTICS, Oakland Municipal Airport, Oakland (Cal.) will begin on Aug. 4 a special sheet metal course requiring only three months. The class is being organized to meet the skilled labor demand created by the $15,000,000 worth of airplane contracts held by West Coast factories. The course will be eight hours a day, five days a week, or 480 hours of instruction. To the school's already large fleet of planes used for flight instruction has been added a Stinson Reliant, powered with a 260 hp. Lycoming.

• The CURTISS-WRIGHT TECHNICAL INSTITUTE OF AERONAUTICS, Grand Central Air Terminal, Glendale (Cal.) has had three more enrollments in the first six months of 1936 than in the whole year of 1935. The special high school teachers' summer training course has been resumed, under the direction of Willard Staples.

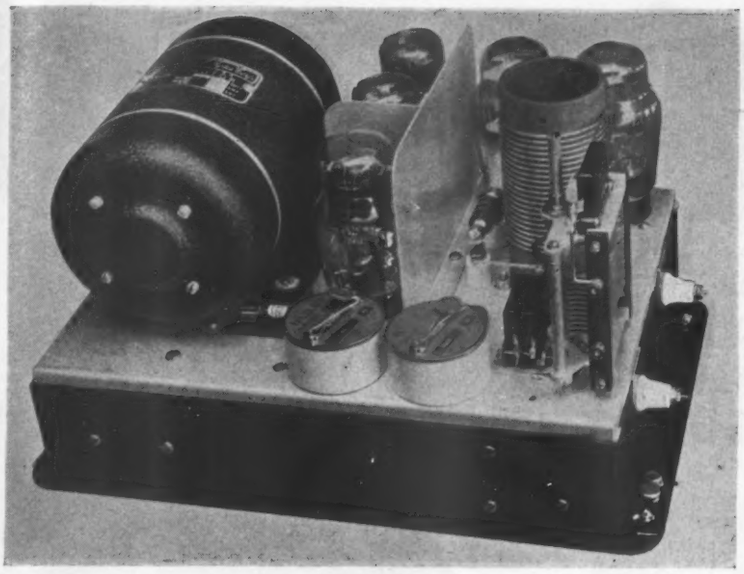
• GRAND CENTRAL FLYING SCHOOL which is headed by Joe Plosser at Grand Central Air Terminal, Glendale (Cal.) has added a 125 hp. Kinner-powered Travel Air to its training fleet. Glen Binkley has been added to the school's mechanic's staff for line maintenance.

• The entire spring term class of PARKS AIR COLLEGE, East St. Louis (Ill.) was placed in jobs before its members had received their diplomas.

• ROOSEVELT AVIATION SCHOOL, Roosevelt Field, Mineola (N. Y.) is having two additional hangars remodeled and equipped for the elementary classes. A floor space of 20,000 sq.ft. will be added to the present 30,000 sq.ft.

• The RYAN SCHOOL OF AERONAUTICS, Lindbergh Field, San Diego (Cal.) was expecting the largest enrolment in its history for the summer term, according to T. Claude Ryan, president.

• The TRI-STATE AIR SERVICE will reopen Fokker Field at Glendale (W. Va.) for passenger service and student instruction. Chief pilot will be James Fette, of Wheeling. Joseph Higgins is head of the new organization. . . . Student flying at AIR ACTIVITIES, INC., Houston (Tex.) Municipal Airport, has shown a marked increase. . . . The WPA ground school course at MIAMI (Fla.) graduated 455 students late in June. . . .A. M. GALES, HAROLD YEAGER, ERNEST DUCLOS and EDWIN S. BOYCE, Moline (Ill.) Airport, have purchased a new Taylor Cub for student instruction. . . . BEAUFORD R. DAKE has leased the Orange-Athol Airport, Athol (Mass.) where he will open a flying school. He will use a Stinson Detroiter and an Avro-Avian. . . . EAST COAST AIRWAYS, based at Clark Airport, Hanover (Mass.) has added two more instructors to its staff: Fred Bedell and Lieut. John H. Patterson. A number of new students have signed up for flight instruction. . . . HARRY BOGGS has bought a new Taylor Cub for student instruction at Middlesboro (Ky.) Airport. Several new students are training. . . . The WPA is planning an aviation ground school in YONKERS (N. Y.) under the direction of Jack Wright. The course will include navigation, radio, meteorology and chemistry as it relates to aircraft. . . . PAUL MAXWELL, of Renovo (Pa.) has ordered a Taylor Cub for student instruction. . . . Plans are being made for the opening of a WPA ground school at Greenwich (Conn.) under the direction of GEORGE A. LOOMIS. . . . By early June WAYDE STEWART and JAY SODOWSKY, joint managers of Parkersburg (W. Va.) Municipal Airport, had soloed seven students. All student instruction is in a Taylor Cub. . . . The WPA will conduct a ground school at the ALBANY (N. Y.) Airport. . . . EARL HANSEN and AL GILLIS have formed a flying school at Great Falls (Mont.) Airport, where they will use a Taylor Cub for instruction. . . . RAYMOND VAN DE VEIRE is planning to give flying instruction to a group of twelve at Bendix Municipal Airport, South Bend (Ind.). When they are licensed they will fly for Leonard J. Schrader & Co. as bonded pilots for the delivery of new planes from factory to distributor or consumer. . . . FRED M. LENCIONI has purchased a new Taylor Cub for student instruction at Santa Rosa (Cal.) Municipal Airport.



1936 model Westinghouse Transmitter

RELIABILITY • • • COMPACTNESS • • • LIGHTWEIGHT • • • PLUS • •

check these features

A 100% modulated, 20 watt aircraft telephone transmitter which operates from a standard 12 volt battery.

Light weight **. . . . One of the lightest sets completely installed per watt output. Weight 25 pounds, 8 ounces.**

Power output **. . . . 20 watts, giving unusual range.**

Inexpensive tubes **. . . . Readily obtained in any radio store.**

Economical **. . . . Low battery drain.**

Easily installed **. . . . Needs only one cable and plug to connect with remote control. Small installation charge because of simplicity. Needs no expert.**

Instantaneous operation **. . . . Made possible by quick heat tubes.**

Two operating frequencies **. . . . 3105 and 3120 kc.**

Compact **. . . . Dynamotor built in. Measures 12¾ x 8 x 8¼".**

Remote control head **. . . . in a standard aircraft instrument case.**

Luminous dial **. . . . Antennae current indicated on instrument panel.**

Lord shock-proof mounting **. . . . Adds long life to tubes.**

Any length remote control **. . . . Set may be mounted in most convenient place.**

Easily serviced **. . . . Removable as a unit. Convenient test jacks.**

TYPE ER Receiver

High performances, easily installed and operated and convenient to inspect, this 5-tube ER Receiver offers reception on three bands plus a pretuned frequency. Operates on 12-volt battery. Instrument case or individual panel mounting also supplied for remote control. Weighs 18 lbs. without cables and remote control. 8¼x6⅞x13⅜" exclusive of controls and mounting feet. Remote control unit is 5½x4x1½".

DEALER FRANCHISES AVAILABLE IN CERTAIN LOCALITIES

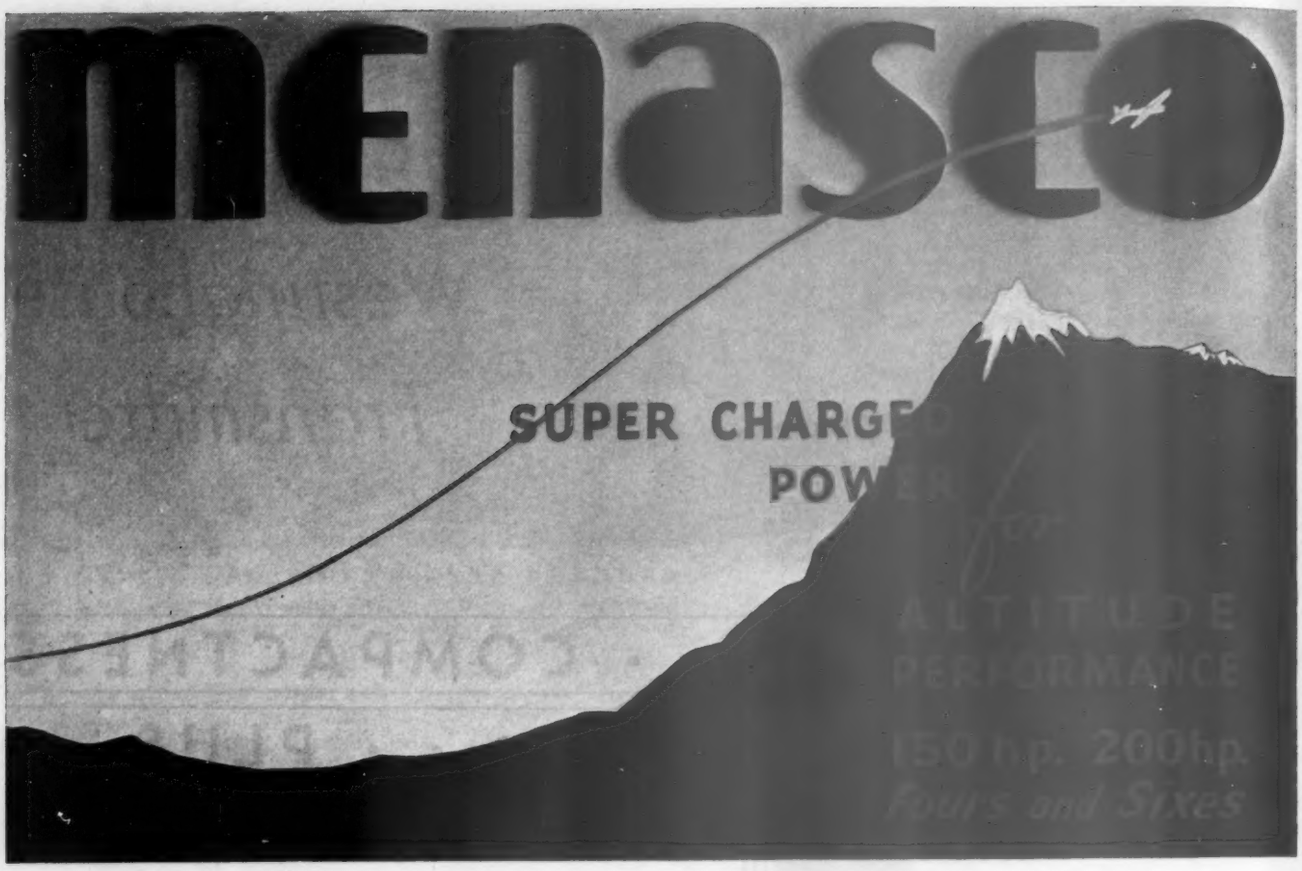
Westinghouse Electric & Manufacturing Co.

Radio Div., Chicopee Falls, Mass.

AILOR SALES CORPORATION

Roosevelt Field, Mineola, N. Y.

WESTINGHOUSE 1886 W 1936 GOLDEN JUBILEE **Westinghouse**



MENASCO MANUFACTURING CO., 6714 McKINLEY AVE., LOS ANGELES, CAL.
IN ENGLAND: Phillips & Powis Aircraft, Ltd., Reading

REFINERY-SEALED CANS protect the purity of Kendall Oil against dirt, dust or contamination. This quality oil is refined by special processes 100% from Bradford Pennsylvania Crude. You can get Kendall at most airports throughout the country.

KENDALL REFINING COMPANY · BRADFORD, PA.

America's First Aircraft Insurance Group

—USAIG—

Over 11,000 paid losses
Broad policies
All American Companies

—USAIG—

UNITED STATES AVIATION UNDERWRITERS
INCORPORATED

80 John Street
New York City

724 So. Spring Street
Los Angles, California

Aviation People

Who's who and what they are doing

• AVIATION, proudly reviewing twenty years of aeronautical progress in this issue, pauses in tribute to Earle L. Ovington, air mail pilot No. 1, who died on July 21st. On September 23, 1911 Ovington picked up the first sack of air mail at Garden City, L. I., ten minutes later tossed it from his Gnome Rhone rotary-motored Bleriot to the waiting postmaster at Mineola, L. I., ten miles distant. Thus was put into practical operation the first delivery of mail by air. Graduated from M.I.T. in 1904, Ovington's flight training was received at the Bleriot School in France in 1911. In 1909 he won a $10,000 purse for a 160 mile cross-country derby from Boston to Providence and return. During the World War he served with the Navy as Lieutenant Commander. His later years were devoted to consulting engineering and he was owner of the Ovington Air Terminal at Santa Barbara. A founder of the Early Birds, he was also a member of the Q.B. and National Air Pilots Association.

Earle L. Ovington

Sidney L. Shannon

• CHARLES W. FRANCE has been elected vice-president and general manager of Curtiss-Wright Corporation assuming full charge of the St. Louis plant. Mr. France's flying experience with the British Royal Flying Corps during the War led him back to aviation in 1929 as Division Superintendent of Western Air Express. In 1934 he became operations manager for Eastern Air Lines, first at Atlanta, later at Miami, resigning to accept his present post.

• Upon resignation of Charles W. France as operations manager for Eastern Air Lines, Sidney L. Shannon was appointed his successor. A barnstormer in 1926, Shannon later formed his own flying service, joining Pitcairn Aviation in 1929. He steadily advanced when that company was absorbed by Eastern Air Lines, becoming superintendent of the Northern and Eastern division of the line, now its operations manager with headquarters at Miami and Newark. His former job is taken over by George E. Gardner who has heretofore been superintendent of the Western division. Previously he had been connected with the Department of Commerce.

• FAIRCHILD AVIATION CORPORATION'S newly appointed director and vice-president, Col. Virginius E. Clark, retired as chief aeronautical engineer of the U.S. Army sixteen years ago. Since then his designs have won many Army and Navy competitions, and his airfoils have been utilized on a large proportion of American planes, including record-breaking ships. Upon retirement from the Army he joined the Dayton Wright aircraft plant controlled by General Motors, and in 1923 became vice-president and chief engineer of the newly organized Consolidated Aircraft Corporation.

• Upon resumption by Commander Wadleigh Capehart of his duties as executive officer at the Naval Air Station, San Diego, Capt. Arthur L. Bristol, formerly skipper of the carrier Ranger, assumed his duties as commanding officer of the air base.

• HERBERT L. SHARLOCK has been elected vice-president, director of publicity, of Bendix Products Corporation. Mr. Sharlock is widely known in the industry through his many years connection with the publicity and exhibit activities of the Bendix enterprises, notably the Bendix trophies.

• A familiar figure about the Washington offices of the Aeronautical Chamber of Commerce, Louis Inwood, is now to be found behind a desk of the Interstate Commerce Commission. Code Authority for the commercial aviation industry during the once-upon-a-time NRA, he had also actively assisted Fowler W. Barker, secretary of the Fixed Base Operators and Airport Committees of the Aero Chamber, in conducting nation-wide conferences of airport and fixed base operators held during the summer of 1935. Recently he has been engaged in a study of pending and impending legislation for the Chamber. Prior to joining the Chamber he was secretary of the Independent Operators' Association.

• Shifts in the publicity field: Richard Rummel from Boeing Aircraft Company to United Air Lines at Seattle. Harold Mansfield, formerly with the Seattle Post Intelligencer, takes his place at Boeing.

• Bureau of Air Commerce has lost Inspector James N. Peyton to TWA. Peyton is now a first officer with the air line, having formerly been stationed at Oakland Airport where he conducted flight tests and made annual inspections of airplanes. He is not new to commercial piloting, having flown the mail between Montreal and New York in 1929.

• IN recognition of the growing importance of its sales department, American Airlines has placed MELVIN D. MILLER in the new post of vice-president in charge of sales, with headquarters in Chicago. Mr. Miller, general sales manager for the past year, has also been named to the board of directors. He was at one time professor of business administration at the University of Texas.

• Divided equally between the American Rocket Society and Alfred Africano, its vice-president, is the Rep-Rirsch Prize of 5000 francs awarded by the Astronomical Society of France. The Society won its share by reason of ground tests made under the direction of John Shesta, president, from which were developed a successful rocket motor and a successful method of handling liquid fuels in rockets; also for shooting the first rocket to attain a speed of 700 m.p.h. Mr. Africano's contribution was the compilation from the tests of three empyrical formulas which are now recognized as a basis for calculating performance of rocket motors, and the designing of a rocket that reached an altitude of 7½ miles.

• The first technical meeting on production problems to be held by the aircraft

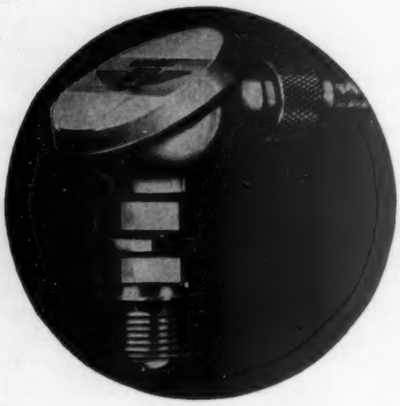
MEXICO CITY

to

LONDON

···23,000 MILES

on the original set of Bendix H-T Spark Plugs



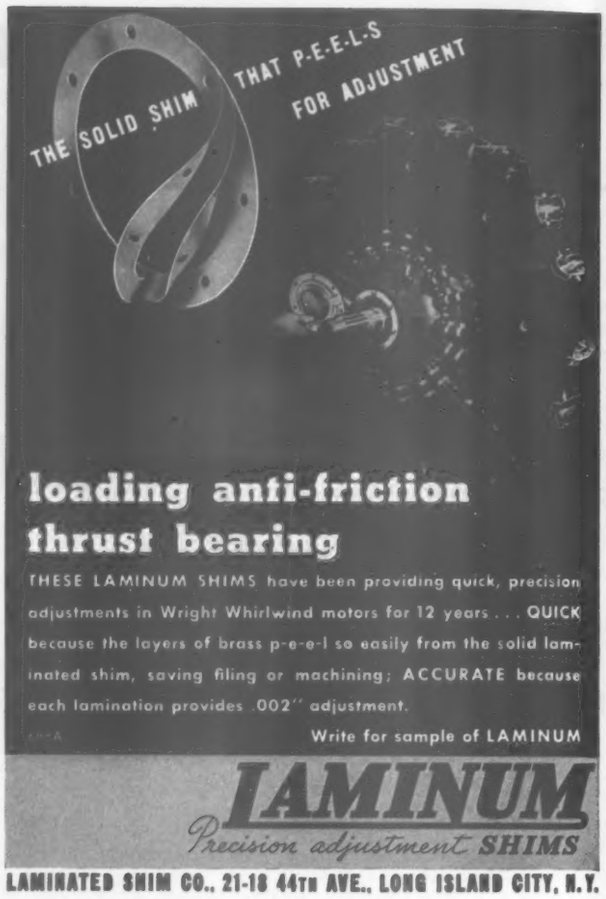
TO the list of notable flights in which Bendix H-T Aircraft Spark Plugs have participated, Mr. Harold Farquhar adds another inspiring entry. His recent 23,000 mile flight from Mexico City to London was completed with the identical eighteen Spark Plugs installed at Wichita before the start. Such performance is typical of the high degree of reliability of this widely used ignition equipment.

SCINTILLA

MAGNETO COMPANY, INC.

(Subsidiary of Bendix Aviation Corporation)

SIDNEY, NEW YORK



loading anti-friction thrust bearing

THESE LAMINUM SHIMS have been providing quick, precision adjustments in Wright Whirlwind motors for 12 years . . . QUICK because the layers of brass p-e-e-l so easily from the solid laminated shim, saving filing or machining; ACCURATE because each lamination provides .002" adjustment.

Write for sample of LAMINUM

LAMINUM

Precision adjustment **SHIMS**

LAMINATED SHIM CO., 21-18 44TH AVE., LONG ISLAND CITY, N.Y.

INCREASE YOUR PAYLOAD WITH BERRYLOID ZINC CHROMATE PRIMER P-27!

● Take on *extra* payload and boost your flying profits! Berryloid Zinc Chromate Primer P-27—new light-weight surfacer adds 12 to 15 pounds to your plane's lifting capacity! Unusually anti-corrosive, too—fights costly rust—saves money! Write for latest booklet on P-27. Address:

BERRY BROTHERS

PAINTS • VARNISHES • ENAMELS • LACQUERS

DETROIT, MICHIGAN ★ WALKERVILLE, ONT.

Learadio AVIATION COMMUNICATION EQUIPMENT

A COMPLETE

TWO-WAY RADIO COMMUNICATION SYSTEM

WEIGHS ONLY 23 lbs.

INCLUDING RECEIVER TRANSMITTER AND DYNAMOTOR POWER SUPPLY

15 WATT TRANSMITTER **3-BAND RECEIVER**

Lear-O-Phone T-15, 15 watts 100% modulated; 2900-7000 KC; Size 5"x5½"x7½"; Weight 7 lbs., battery drain 11 amperes. Learadio R-3 Receiver 3 bands, 150-405 KC; 545-1600 KC; 2320-6600 KC; Weight 7 lbs; static reducer; shock mounting for 3 positions. Price for complete 2-way system less than $400.

Write for Bulletin No. 7

Lear Developments, Inc., 121 W. 17th St., New York, N. Y.

industry will take place next October in Los Angeles, under the sponsorship of the Society of Automotive Engineers. Cooperating will be the Aeronautical Chamber of Commerce and the Air Transport Association. CARLETON E. STRYKER, chief engineer, Curtiss-Wright Technical Institute, has been appointed general chairman of the three-day meeting. MAC SHORT, Stearman Aircraft Company, is vice-president of the Society representing aircraft engine interests, and OPIE CHENOWETH, U. S. Army Air Corps, is vice-president representing aircraft engine activities.

• W. H. WORDEN, district passenger agent for American Railway express for ten years, is now with Eastern Air Lines, managing traffic for the New Orleans district. He succeeds Sam Wilkes who has been made division manager in Atlanta.

• Aviation people visiting this country from abroad: The Hindenburg brought OTTO F. MERKEL, former managing director of Lufthansa, now associated with Dr. Rohrbach in the manufacture of German aircraft. He returns on the same ship Aug. 19, after a trip to the West Coast to inspect aeronautical manufacturing facilities . . . ROY MAKEPEACE, manager of the Rand Airport, Johannesburg, South Africa, selected by the Carnegie Corporation to study and report upon design, production and management of airports and air traffic control in the U.S., leaves here the latter part of August to make a similar tour in Europe. . . . PIERRE JANET, French war pilot and operations manager of Chargeurs Reunis, came to take delivery of three Sikorsky amphibians for operation in West Africa . . . PRINCE LOUIS FERDINAND of Germany, now with Lufthansa, an observer of American airlines operation . . . DR. GUSTAV LACHMANN, associated with F. Handley Page in the development of slots, flew about the country on a postman's holiday . . . LT. COL. CHANG TSU CHIEN, commandant of the Air Force Technical School, Republic of China, and an alumnus of M.I.T., re-visited old friends . . . F. R. BANKS of Shell Oil Company and W. E. ROOTES of Rootes, Ltd., London, also visiting . . . a special commission from the U.S.S.R. to study scientific research on aerodynamics, composed of G. N. MOUSSINIANTZ, chief of the aerodynamic laboratory of Z.A.G.I., PROF. V. S. PYSHMOV, of the Jukovsky Air Academy, MESSRS. K. K. BAOULIN, I. F. PETROV and N. D. DOBROKHOTOV, engineers with Z.A.G.I. . . . J. LECOINTE, F. RICARD, J. ROOS and G. DUMERLE of the French Air Ministry, and MESSIEURS CLAUDE, BLUTEL, DANIEL, WEILL, PUBELLIER, LABEYRIE, PLOIX, VERDIER, SCHNEIDER and COLAS RENAULT, commercial representatives, who are on an inspection tour.

Side Slips

By Robert R. Osborn

THE non-stop service between New York and Chicago is certainly a big step forward in aviation.

The rapid advances in aeronautics always seem to be more amazing to the people actually in the business than to the general public,—at least we have noticed that reaction among our acquaintances in and out of the industry. One thing which makes this newest milestone stand out to us is an occasion we remember from eight years ago. The manager of a flying service had written some material for an advertising folder and asked us to criticise it. His first sentence for the proposed book-

let reads, "In case of a forced landing on a cross-country flight, the passenger pays a proportion of the quoted price for the full trip according to the ratio of mileage."

AS NEAR as we can make out from reading the testimony before the Senate Military Affairs Committee regarding the proposed airport for Governor's Island, New York, it would be an ideal airport which could operate only under restrictions, the dredging would improve the channel and the filled-in land would be a menace to navigation, and it would have perfect weather but would be unsuitable for the blind approach radio landing system.

THE PICTURES of Max Schmeling boarding the Zeppelin "Hindenburg" for the triumphant return to Germany were interesting. And of the large group of sports writers who saw him off, probably every one of them expected him to be going home with the aid of crutches or a wheel chair.

The papers report that the Nazi government ordered the newspapers not to accept any more articles from the German sports writers who predicted Schmeling's defeat. Of course that "can't happen here," but if it had there certainly would have been a sudden rush for the relief rolls.

THERE is interesting news about "Colonel" Hubert Fauntelroy Julian, the former "Black Eagle of Harlem." The Associated Press dispatch states that the former self-styled Chief of the Ethiopian Air Force has changed his name to Colonel Huberto Fauntelroy Juliano, has become an Italian citizen and is pushing plans for a flight from New York to Rome.

Of course it's his own affair but we'd advise the Colonel against making that flight. Think of the possibilities in case of a forced landing in the wilds of Harlem!

IN AN ARTICLE reporting the settling by the Post Office Department of five suits arising from the cancellation of the air-mail contracts, the New York *Herald Tribune* quotes from a letter by Attorney General Cummings:

"Reports of the inspectors to the Post Office Department and other available data relating to this and other mail contracts have been fully examined. There can be no reasonable doubt that the arrangements, understandings and agreements out of which the route certificate subsequently grew were highly irregular, and interfered with the freedom of competition contemplated by the *statues.*"

If he has been correctly quoted, it appears that the Attorney General must have been confused regarding which of the New Deal acts he was rendering an opinion. So far as we know it is only among the WPA and PWA workers that we have contemplation by the "statues."

A BRITISH flying lieutenant offered apologies for having flown so close to the Normandie that his seaplane hooked its wing on a cargo hoist and cracked up on the forward deck, but he has certainly placed his countrymen in an embarrasing position. Now somebody will have to crack up a much larger airplane on the deck of the Queen Mary.

A CANADIAN TRAPPER who pilots his own airplane on his route through the Northwest territory returns to civilization with the complaint that two grizzly bears pulled the door off of his

ship and damaged the fabric while it was parked in the snow one night. We suppose that the grizzly bear can do a lot of damage to an airplane, but this trapper-pilot can consider himself fortunate that the American souvenir hunter does not range that far north.

MACWHYTE

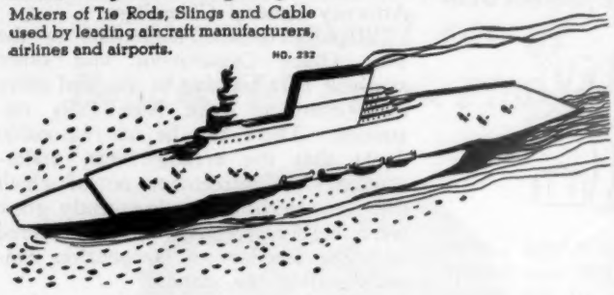
- STREAMLINE
- SQUARE
- ROUND

TIE RODS

Made in accordance with A-N specifications to meet all physical requirements such as tensile, bend and salt spray tests. Internal Rods (round or square) are cadmium plated carbon steel or stainless steel. External Rods (streamline) are stainless steel or cadmium plated carbon steel.

Macwhyte Company · Kenosha, Wisconsin

Makers of Tie Rods, Slings and Cable used by leading aircraft manufacturers, airlines and airports.



THE NEW "CUB" IS SAFE • ECONOMICAL • STURDY • STABLE

Undisputed Leadership goes to

The FLEET *New* "CUB"

The finishing end of Production Line at the enlarged CUB Plant.

Now 20 CUBS made and sold weekly

PAY JUST **$490** CASH and Fly it home—

EASY Monthly Payments

POPULAR demand did it! Production *had* to be increased. Everybody liked the New CUB from the very first; and from the way orders poured in everybody *wanted* one immediately. (Sales increased over 200% over last year.)

Every effort was made to fill this avalanche of orders but it just couldn't be done and maintain the high standard of CUB workmanship. But that has all been changed now.

Anticipating the popularity of the New CUB, ground was broken last winter to double the size of the factory. Even that had to be changed. Construction was stepped up to THREE TIMES the former capacity.

Now that construction is completed and operations are functioning smoothly, with 200 men working in shifts, night and day, a steady flow of 20 CUBS pour forth from this highly coordinated plant weekly.

NOW, expect QUICK DELIVERY of your New CUB.

TAYLOR AIRCRAFT COMPANY

No. 8 A Street, BRADFORD, Pennsylvania

LIKE A RADIO BEAM

"Classified" advertising guides your used plane advertisement straight and true to possible buyers among the close-to-16,000 readers of AVIATION. It is always "there," in good or bad weather, to help you find a new "home port" for the plane you have for sale.

The U. S. Army Corps' first official purchase of Grade A airplane fabric under the new specifications for weight and sizing was

B ★ A ★ 30

the fabric that had been conforming to these new standards since it was first produced, nearly three years ago.

WELLINGTON SEARS CO.

65 Worth Street — New York City

Looking for something?

—of course you are. Every reader of AVIATION is. Some find what they are looking for in the editorial pages, some in the advertising by manufacturers, some in the "Classified" advertisements. The latter include many advertisements seeking, or offering, the "something"—an employment, plane, engine, part, product or business opportunity—that *you* may be able to supply or want. You will always find checking the "Classified" ads interesting, informative and, sometimes, profitable.

STANAVO

AVIATION GASOLINES AND OILS